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The Greenside Lead Mines, Cumberland

Mines in Cumberland, England, Which Have Been Opened over 200 Years Are Still Large Producers. Mining and Milling Methods

BY E. THOMAS BORLASE*

This mine, one of the largest producing lead mines in Great Britain, holds also the distinction of being the oldest producing lead mine in the north of England. It was opened during the latter part of the 17th century, but during that period very little work was done more than prospecting and working on the outcrop of the lode. About 100 years ago, it was bought by the present company, and since then it has been most extensively worked and large returns have been made. The mine is situated in the heart of the English lake district, at the head of Lake Ulleswater, on a flank of the Helvellyn mountain range, and at an elevation of about 1000 ft. above sea level.

FIG. 1. GENERAL VIEW OF MINE

FIG. 2. ELECTRIC MOTOR AT MOUTH OF ADIT

Operations in the early days were commenced at about 2000 ft. above sea level, but the whole of this ground being exhausted, the workings are now confined almost entirely to the lower parts of the mine.

Geology.

The rocks of the district are of the Ordovician age, and are locally known as the volcanic series of Borrowdale. They consist of large accumulations of bedded volcanic ashes, which are interstratified with lava sheets. These beds attain a great thickness, and cover an area of no less than 400 square miles.

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The bearing of the vein is almost due north and south, and the dip is from west to east, in some places as much as 3 ft. in a fathom; it is intersected by many cross-courses, running east and west, which are not ore-bearing, and frequently change the course of the lode giving it a slight bend to the west. These cross-courses, although not in themselves ore-bearing, cause in many instances an enrichment in the lode, either before reaching the cross-course or on immediately passing through.

The vein appears to be a large fissure crack, caused by the faulting of the country and very likely water deposition has been the source of the vein filling. The vein walls are exceedingly hard and exhibit no signs of movement creating slickensides, the filling being, as it were, frozen to them, as when first it became deposited; thus bearing out the theory of deposition by water.

The vein filling consists of galena, blende, copper pyrite, quartz, calcite and barytes, occurring chiefly in a light gray felsitic rock. At the outcrop the galena and other minerals were very much disseminated throughout the rock, in strings varying in thickness from ¼ in. to 3 or 4 in. These strings continued toward the east, enabling the ground to be profitably stoped out to a width of 50 ft., and in some exceptional cases reaching 60 ft.

Continuing downward the vein has become more concentrated, and the average width of the present workings now varies between 10 and 20 ft. The ore-producing ground is about 300 fathoms long, but it is separated into three sheets of ore by two pillars of dead ground, each about 50 fathoms long and situated on the north and south side of the shaft.

Workings of the Mine.

Until recent years the mine was worked by a succession of adit levels, commencing at the top of the mountain. But having reached the level of the country with the lowest adit level, and finding that the lode continued downward, a vertical shaft was sunk from this level.

This shaft, situated in the middle of the property, is distant about 1½ miles from the mouth of the adit. Rectangular in shape, 13x9 ft. in size, it was commenced at about 96 ft. from the lode in the hanging wall, intersecting the lode at a depth of 270 ft., and has been continued to its present depth of 540 ft. The mine is opened by four levels placed at intervals of 120 and 75 ft. apart on the vertical shaft; these levels are 6x6 ft. and are driven by 3-in. Shram and Champion rock-drills.

Stoping Methods.

For stoping out these levels the overhand method of working predominates, but owing to the hardness of the ground,

the slowness with which it is worked, the sometimes disseminated character of the lode resulting in wide stopes, and the shortage of timber, an unusual method of stoping is adopted, known as the "middling level system."

Fig. 5 illustrates this method of working. It consists of sinking two winzes *A* and *B*, each 9x6 ft. from level to level, at a distance of about 150 ft. apart. From the bottom of each winze and about 6 ft. above the roof of the lowest level, intermediate or middling levels *c*, 6x6 ft., are driven to meet, connecting the two winzes; thus forming a continuous level above the lowest level, having a pillar of ground *D*, 6 ft. thick between. Along this middling level, and at intervals of four fathoms, popper holes or chutes *E* are sunk through the middling, connecting the two levels, and these convey the stoped out ore into the mine cars placed underneath.

After the preliminary process of driving the middling levels, sinking the winzes and hopper-holes has been completed, overhand stoping is commenced in the roof of the middling level and proceeded with in the usual manner. All the ore ground, with the exception of a corresponding 6 ft. middling, which is left in to support the floor of the level above, is excavated and stored in the stopes, the men working on the top of the stuff.

When the whole of the ground has been worked out, the broken ore is then drawn out, and the middlings or pillars of ground left in are then worked away; or they may be allowed to remain and the workings filled with barren rock obtained from other parts of the mine.

The ground is stoped out in hights of 12 ft. by double-hand drilling with ⅞-in. steel drills. Machine drills are in some cases used for taking away the first run of stopes, say 6 ft. high above the middlings.

For blasting the ordinary granular black powder and dynamite are used. Owing to the peculiar nature of the ground, the holes are first fired with a charge of powder, and this cracks or rends the ground; then it is charged and fired with dynamite which brings down its burden.

The charging and firing of the holes first by powder and then by dynamite serves a two-fold purpose; it breaks a larger quantity of stuff, in larger lumps, owing to the rending of the powder, and produces less galena fines for the mill; thereby resulting in more efficient concentration.

FIG. 3. WORKING SHAFT UNDER GROUND

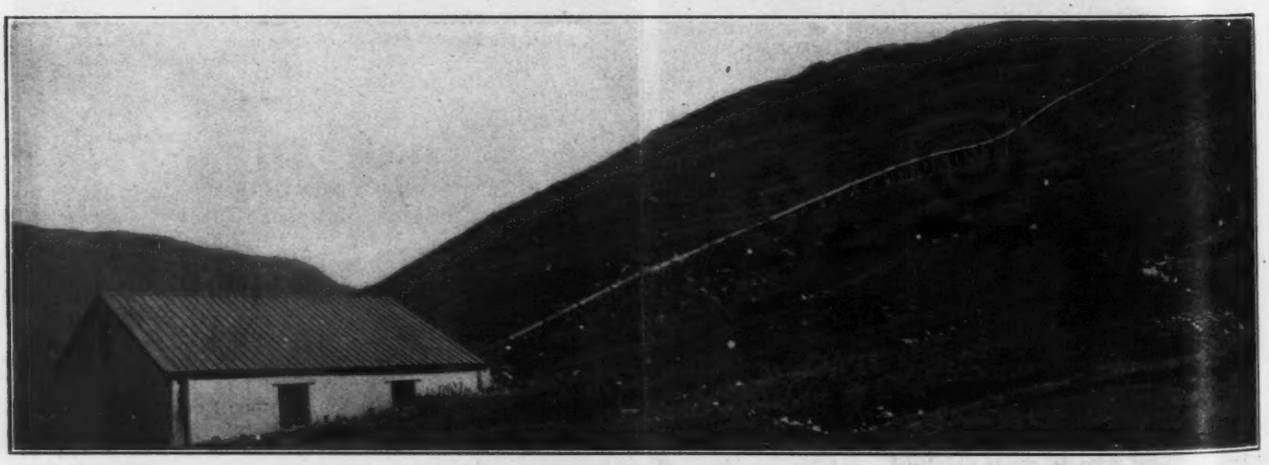


FIG. 4. GENERATING STATION AND PIPE-LINE

The Power Plant.

Another feature with regard to this mine is that it is entirely worked by electricity generated by water turbines. The source of power is obtained from two large reservoirs, situated at the base of the Helvellyn mountain, at an elevation of 2000 and 1500 ft. above sea level, and two miles distant from the mine. The water is conveyed from these reservoirs through partly covered flumes 4 ft. wide by 12 in. deep, and these follow the contour of the hill for 1¼ miles, discharging into a pen-trough at the head of the pipe-line. The pipes, which are 15 in. in diameter, convey the water to the generating station, Fig. 4, situated at an elevation of 1250 ft. and distant from the mine about ¾ mile. The vertical fall of water is approximately 420 ft. on a length of 1200 ft. pipe-line, which is equivalent to a fall of 1 foot in 3.

The pipes discharge at the bottom through a Y-piece, having its respective ends attached to a Vortex turbine and a Pelton wheel, which drive by means of belts two compound-wound continuous current dynamos, each of 100 h.p. and running at a pressure of 100 volts.

The power is conveyed to the mine by copper wire cables 19/15 B.w.g., fixed on poles and insulators, entering the mine through one of the higher adit levels, and connected to the present working adit by a shaft. All the cables in the mine are lead-covered and supported on insulators fixed in the side of the levels, and on distance pieces in the shaft.

The Vortex turbine and generator supply power for a 50-h.p. compound wound winding motor, situated underground at a distance of two miles from the generating station, and lifting the lead ore stuff in mine cars from the present working levels to the adit. The working load averages about three tons.

Underground Haulage

The turbine also supplies power for driving a 14-h.p. electrical locomotive, Fig. 2, working in the adit level. The current is first conveyed from the cables supplying the winding motor, to a motor transformer which converts the pressure of 600 volts down to 250. It is then delivered to the locomotive by No. 10 B.w.g. phosphor-bronze wires, which are necessarily bare and fixed on insulators in the roof of the levels.

The distance which the locomotive hauls the stuff is 1½ miles, and the journey is completed in about 20 minutes; the irregularity of the level and the numerous curves will not permit quicker running. The weight is approximately 2½ tons,

and the load which it draws consists of 12 cars, varying in weight according to the quality of the stuff, but averaging about 1½ tons each.

This locomotive has been continuously working for the past 13 years, the total expense working out at a cost of 0.5c. per ton-mile over the whole period.

Other Machinery

The Pelton wheel plant generates power for supplying a 50-h.p. motor driving a single-cylinder air compressor, working underground, and also two 10-h.p. electric motors, driving two of Tangyes three-throw ram-pumps, stationed at the 360-ft. and 540-ft. levels and pumping water corresponding distances. This plant has an almost constant load and therefore requires very little supervision when once started; but in case of emergency it is supplied with an automatic magnetic electric cut-out.

The shaft of the Pelton wheel is fitted at its extremity with a small drum having a rope and weight attached, and held in place by a pawl gearing with a ratchet wheel on the end of the drum. Should one or both motors switch off at the same time, the cut-out drops out and falls on the pawl, which in turn relieves the ratchet wheel and through the weight attached to the drum, the shaft is wound into the supply valve, thus reducing the speed of the machine and bringing it to a standstill.

The turbine plant, having a varying load, requires constant regulating, and this is attained by the man in charge operating a 3-in. by-pass valve. Although many hydraulic governors have been experimented with for this purpose, none have proved effectual.

The station is worked in two shifts of eight hours' duration, the hours being from 6 a. m. to 2 p. m. and 2 p. m. to 10 p. m., one man being in attendance during each shift.

The working cost of the plant, including all supervision, works out at 3½c. per horse-power per working day of 16 hours.

The underground stations at the different levels, including all engine rooms, are lighted by sets of six 100-volt 16-c.p. lamps, wired in series. For the lighting of the concentrating mills, offices, and buildings, an accumulator plant is provided, this being charged by a motor supplied from the main generating station.

Milling Plant.

The ore drawn out of the mine by the locomotive is first subjected to hand picking or sorting, and for this purpose it is discharged into two large hoppers, or kilns, constructed of stone, having sides and ends sloping downward toward the front. Fixed at the bottom of each hopper are two heavily constructed grizzleys, placed one below the other, and on the underside of the bottom grizzley is attached a three-mesh screen.

The roughs, failing to pass the top grizzley, are picked out of the waste, and stored in suitable bins. The smalls passing through are caught on the lower grizzley and discharged into a car conveying them to other bins. The fines, passing through the two grizzleys and screen, are taken away by the water and settled in settling tanks.

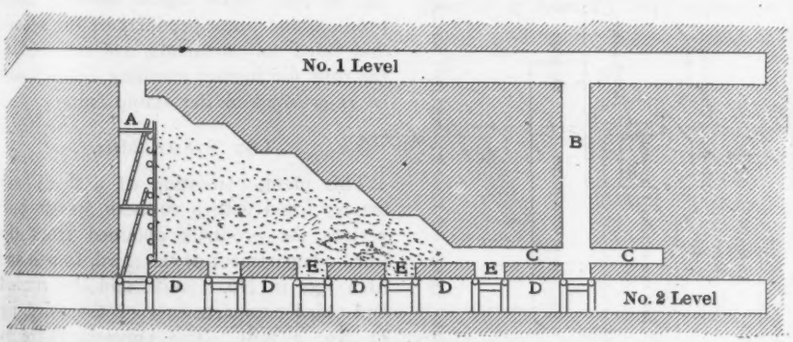


FIG. 5. MIDDLING-LEVEL SYSTEM OF STOPING

This plant is situated at the mouth of the adit, and at a point 150-ft. below the crushing and dressing plant; the different sizes obtained are hauled up an incline by a self-tipping car actuated by a 20-h.p. vortex turbine and these are again stored in separate bins.

The roughs from these bins are fed to a 10x20-in. Blake-Marsden stone-breaker, driven by a 15-h.p. vortex turbine and breaking them to 1-in. cubes, which pass through and discharge into a chute along with the smalls and are conveyed to a set of three 16x17-in. Cornish rolls. The top pair of rollers are of the fluted type, and from these the ore drops in equal quantities into two sets of plain surface rolls placed beneath. The rolls are driven by an overshot water-wheel, 30x4½ ft. in size.

At this stage more water is added, and the crushed ore, along with the fines obtained from the picking grates, is passed through a cylindrical revolving trommel of 2½ mesh placed below the rolls; the undersize goes to No. 1 mill and the oversize is discharged into a car conveying it to No. 2 mill.

The undersize is fed to No. 1 mill passing through a set of three trommels of three, four and six meshes per linear inch, the oversize from the first two supplying two four-compartment Hartz jigs, and that of the six-mesh being delivered to a three-compartment jig. The undersize from the last trommel is conveyed to a set of four V-shaped hydraulic classifiers, each supplying four three-compartment Hartz jigs. From each jig is obtained a clean concentrate of galena, caught in suitable tanks placed underneath, and thence conveyed to the finished products bin.

The oversize going to No. 2 mill and commonly known as "raff," is fed by an automatic feeder to a pair of large Cornish rolls 14x36 in., of the plain surface type, and being crushed is screened in a three-mesh trommel placed below.

The oversize is again elevated and returned to the same rolls; the undersize passing on to two trommels of six and eight mesh, the oversize of each feeding two three-compartment Hartz jigs. The undersize from the eight mesh trommel passes on to two hydraulic classifiers each feeding a three-compartment jig.

The jigs and trommels of No. 1 and No. 2 mills are worked by a 15-h.p. vortex turbine.

The overflow of the last classifiers in both mills, is conveyed through launders to two large, free-settling classifiers, placed on a lower floor. The settlings from each are treated alternately in a set of four automatic convex buddles, the heads and middlings being again treated, it may be several times, in another gear-driven buddle, resulting in a clean lead product and waste.

The overflow from the large settling classifiers is discharged into a series of settling tanks, which are cleaned periodically and the settlings fed to a number of buddles on a lower floor. The heads and middlings of these buddles are again re-treated as is the case with those of the automatic buddles.

The tails, along with the tails obtained from the automatic type, are conveyed to the tailings plant, situated on the lowest floor, and fed to a large classifier, the settlings going to feed a rough convex buddle, gear driven; and the overflow passing to a convex automatic buddle. The heads and middlings of each are again re-treated, in their respective buddles, yielding in both cases clean concentrates.

No. 3 Chat Mill

This mill obtains its supply from the second compartments of the first three jigs in No. 1 mill, the first two jigs in No. 2 mill, and the third compartments of the first two jigs in No. 1 mill. The stuff commonly known as chats consists of a mixture of galena, blende, baryta, copper pyrite and iron pyrite, all intermixed.

It is first crushed in a pair of plain

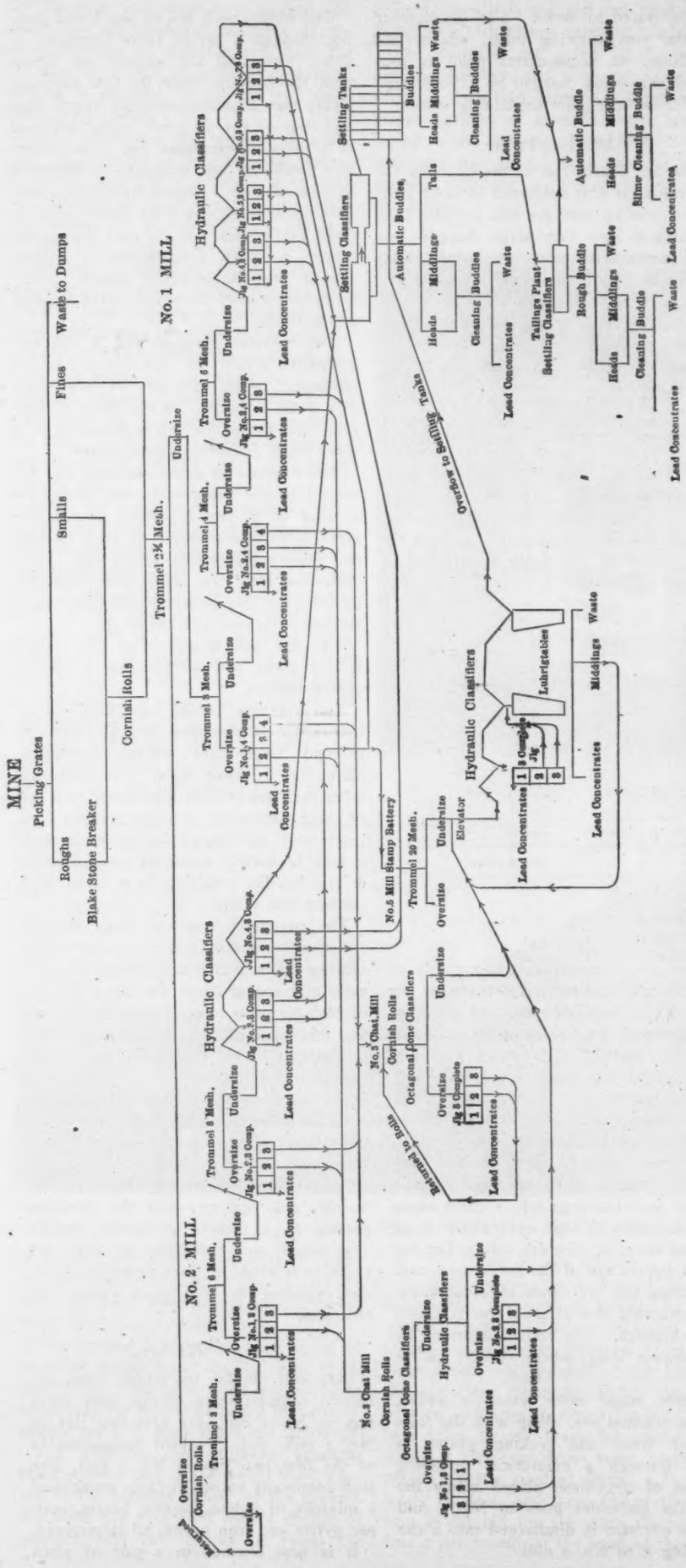


FIG. 6. FLOW SHEET OF CONCENTRATING MILL

Cornish rolls 16x17-in. discharging into an octagonal classifier; the oversize is fed to a three-compartment Hartz jig, the undersize passing to a hydraulic classifier feeding a similar jig, both of which give clean galena products.

The undersize overflowing the hydraulic classifier, is settled in settling tanks and treated when convenient on the Luhrig tables in No. 5 mill; the products obtained from the second and third compartments of the jigs are also again re-treated on the Luhrig tables.

No. 4 Chat Mill.

This mill treats the roughest and poorest quality of chats, obtained from the fourth compartments of the first two jigs in No. 1 mill, and those from the third compartments of the first two jigs in No. 2 mill. The stuff is crushed in 16x17-in. Cornish rolls, feeding an octagonal classifier; the oversize of this trommel goes to feed a third compartment jig, while the undersize is settled in settling tanks, and treated in due course along with the undersize of No. 3 mill on tables. The jig in this house again gives a clean product, and those products of the second and third compartments, are returned to the rolls for further crushing, or they may be re-crushed in the stamp battery.

The Stamp Mill

This plant, consisting of a three-head battery fitted with a 20-mesh screen, pulverizes the products obtained from the third compartment of the third, fourth and fifth jigs in No. 1 mill, and the second and third compartments of the third jig in No. 2 mill. The pulverized ore is then passed to a 20-mesh revolving trommel, along with the products of the remaining jigs in No. 1 and No. 2 mills, which do not need further crushing. The undersize from this trommel feeds an elevator discharging into a set of three hydraulic classifiers.

The settlings of the first classifiers feed a Hartz jig from which is obtained a clean galena concentrate. The two remaining classifiers each feed a Luhrig table, and also make clean concentrates. The middling products of the jig, together with the middlings obtained from the tables are re-treated in separate parcels on the Luhrig tables, and for this purpose they are returned to the elevator.

The clean concentrates obtained from each mill, are stored in suitable ore-bins, those of the slime plant being kept separate from the rougher products, and mixed together in weighing out of the ore on transferring it to the smelting works.

Smelting Works.

The concentrates are first subjected to a roasting process in an ordinary reverberatory roasting furnace, working charges of 16 cwt. each. From this furnace the ore goes to be smelted in a number of

water-back Scotch hearths. The lead is cast into pigs of about 112 lb. each, and sold as silver-lead; it contains an average of 13 oz. silver to the ton.

The slags obtained from the hearths are again smelted in a large rectangular blast furnace. The fumes are conveyed to the top of the hill by flues placed underneath the ground, and about ¾ mile long. These flues are cleaned out about twice a year. The fumes are caught and settled in zig-zag settling tanks, allowed to dry and then smelted on the Scotch hearths.

Determining Hight of Water in Inaccessible Open Pit

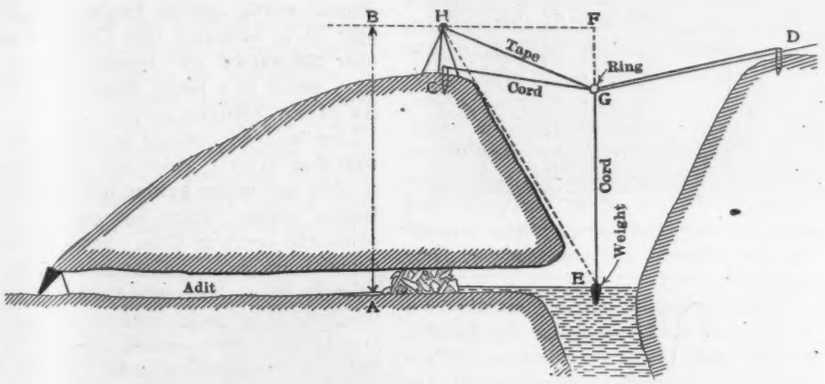
By Benjamin H. Case*

The article in the Journal of Dec. 28 on "Sounding a Difficult Piece of River," by H. W. Hixon, recalls a scheme that I used several years ago to determine the hight of water in an inaccessible open pit.

A small stream of water was flowing through the mass, but as the men worked their way nearer to the open pit there was some fear that the water might be dammed to such extent as to overwhelm them when they broke through.

Mode of Procedure

As the surface of the water in the open pit was inaccessible for determining its hight by ordinary means, I developed the method shown in the accompanying sketch. I first ran a line of levels from *A*, where the men were clearing out the adit, to a stake at *C* on the edge of the pit. I placed another stake at *D* on the opposite side of the pit and to nails driven in both stakes I tied the ends of a strong cord, after slipping a small ring on the cord at *D*. Through the ring I passed another cord and had a weight attached to the end. I tied the zero end of a 100-ft. tape to the ring, and had the reel end carried around the edge of the pit to the transit, which was set up over *C*. An assistant held the end of the weighted cord at *D*. A steady pull on the tape at *H* brought the ring to the point



METHOD OF DETERMINING THE WATER LEVEL IN AN INACCESSIBLE PIT

The East Tennessee copper mine of the Ducktown group had been worked extensively in the early days, both for the oxidized ores and the sulphides. The stopes were carried down from the gossan, or iron hat, through the oxides and sulphides and from wall to wall, making it necessary to place "saddle-back" stulls to support this overlying gossan.

About ten years ago, after a long rainy period, these stulls, which had been weakened by decay, gave way and the gossan mass with a large slice of the hanging wall was precipitated into the mine. The displacement forced a tremendous column of water and debris through an adit which became choked by the mass; this remained choked after the water had subsided.

About three years after this cave-in, the owners of the property decided to open up the adit and explore the mine.

*Copperhill, Tenn.

G, and the man at *D*, by slackening on his cord, allowed the weight to drop to *E*, at the surface of the water. I then measured with the tape the distance from *H* to *G* and with the transit the angle *F H G*. From these data I determined the distance *F H*. I next measured the angle *F H E*, and multiplying the tangent of this angle by the distance, *F H*, previously determined, gave me the distance *F E*, which was approximately equal to *A B*. This proved that it was safe to break through into the open pit.

The V-cut, or center cut, and the stope cut, or end cut, are about equally popular in shaft sinking in West Australia. With the end cut it is easier to keep one part of the shaft ahead of the rest, so as to have a sump for the sinking pump. The direction of the joints and fractures in the shaft should determine the choice between the two.

The Cause of Coal Mine Explosions

By William Griffiths*

The most favorable conditions for gas explosions in this country are to be found in the anthracite mines of Pennsylvania, where they have to deal with large quantities of marsh gas or fire damp; but the mine officials, familiar with the conditions under which explosions are liable, are ever watchful, and consequently few very serious explosions occur in the anthracite region and those which do are mostly local in character, due to sudden outbursts of gas which had escaped the vigilance of the fire boss. We find, however, that explosions in bituminous mines, which are supposed to contain very little or no gas, have been of such frequent and terrific character that the attention of the whole country is immediately called to them.

Our knowledge is still too vague. I, therefore, believe that there exists an important field for more thorough practical investigation by government commission, if necessary, of the causes likely to produce these terrible explosions in mines supposed to be non-gaseous. Many of them are attributed to coal dust explosions, since it is known that coal dust may explode when unmixed with gas. Possibly it does, under certain conditions, yet, there are many who dispute this theory as being insufficient in itself to explain such tremendous mine explosions as have recently occurred. The minimum quantity of gas which can be detected practically in the mines with the ordinary safety lamp is about 2 per cent., whereas, a mixture of 5½ to 6 per cent. of gas becomes explosive without dust, and it has been demonstrated that a mixture of 1½ per cent. or less of gas is explosive if bituminous coal dust is present.

More or less gas exists in nearly all coal mines. It is not improbable, therefore, that the terrible explosions in so-called non-gaseous mines have been caused by the mixture of gas and dust, though the quantity of gas is normally so small that the facilities of the mines are not delicate enough to detect its presence, and therefore the officials have felt secure with the idea that their mines were absolutely free from gas, and not liable to explode, giving little thought to the possibilities of conditions favorable to an explosion occurring quickly, through sudden or unusual outbursts of gas or owing to atmospheric or other conditions favorable to the increase in the percentage of gas above the normal, thus producing with coal dust present conditions favorable to a terrible explosion; the more terrible because such a condition, instead of being local, is likely to prevail through the

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whole mine, extending through all the chambers and gangways, thus allowing an accumulation sufficient to produce an explosion of exceptionally terrific character. As noted above, the margin between the non-detectable gas and the explosive mixture is mighty small, particularly with dust present, which might not have occurred had there been less gas.

The only remedy which is now suggested for the amelioration of such conditions is for the mine officers to keep well informed through the frequent use of instruments which may be secured for detection of small percentages of gas, and to increase the factor of safety by providing an excess of air in the ventilation, with copious sprinkling of the gangways.

The Silver Movement in 1907

The following summary of the London silver market is from the yearly circular of Messrs. Pixley & Abell, who have recorded that market for many years:

"The almost continuous advance in the price of silver which had been taking place for three or four years, owing to the enormous demand for currency in India, during the latter months of 1907, received a severe check. The quotation on Sept. 30 was 30 3/16d. while the closing price of the year was 24⅞d. During the first nine months of the year the highest price was 32 7/16d., and the lowest 29 15/16d., with an average of 31 3/16d., but from Sept. 30 to Dec. 31, the highest price was 30⅞d., and the lowest 24 3/16d., the average for the three months being 27⅛d. The average for the whole year was 30 3/16d.

"Buying for account of the Indian Government was the chief feature of the earlier part of the year, and 63,277,592 oz.—about £8,000,000 in value—was imported into India from Great Britain and elsewhere. At the same time the American and Mexican governments continued their purchases for subsidiary coinage, the former taking some 7,000,000 oz.; while the Paris mint bought by tender 180,000 kg. for colonial coinage. Paris, however, except a small purchase of 4,500 kg., took nothing after September.

"These heavy demands upon the world's production of silver would undoubtedly have carried quotations much higher, had not Mexico continued the sale of her demonetized dollars, which were largely disposed of on the London market. China also was able to ship sycee silver freely, both to England and India, much of the silver which was poured into Manchuria during the late war finding its way to the Treaty ports, and being available for export. The value of the total shipments of silver to India from China, during the first 10 months of 1907, amounted to £2,700,000 in all.

"There was no serious disturbance of the market until early in October, when heavy selling orders came from the Indian bazaars, it being realized there that owing to a partial failure of the rains the crops would be only moderately good and that the Government, with a holding of some 26 crores of rupees in its ordinary reserve, together with a further 6 crores in the special reserve, was well supplied with currency and would not have to make further purchases, at all events during this winter. These sales found the market in a weak condition. Holdings of silver in London were large, and there was a fairly heavy bull account, in anticipation of further demands by the Indian Government. With a general pressure to sell and in the absence of any important buyer prices broke sharply, and with a few, but generally short-lived reactions, prices continued to fall until toward the end of the year, the dearness of money owing to the financial crisis in America accentuating the general weakness and at one time forcing the quotation for spot silver from 7-16d. to ½d. below the quotation for forward.

"During October, November and December the American Government again became a buyer, taking for subsidiary coinage and also for Philippine currency some 7,500,000 oz. in addition to the amount bought earlier in the year. These purchases at this time were important, and doubtless helped to give some steadiness to the market at the close of the year. Mexico also ceased to sell dollars owing to the low prices obtainable, and it is probable that the quantities remaining for disposal are now comparatively small.

"China during the last few months both bought and sold largely on the London market, and owing to Mexican dollars not being obtainable shipments of silver were made to the East for coinage into British and Canton dollars. In Shanghai the holdings of sycee are large and ample. The Indian bazaars were again good buyers for trade requirements, and there is no reason to anticipate any immediate falling off in their purchases because of the partial failure of crops this season. The splendid crops of the last few years have no doubt produced great prosperity among the people.

"In addition to the amount taken by the Paris mint, which we have already mentioned, considerable purchases have been made during the latter part of the year for French account, presumably for colonial coinage. Purchases of silver for coinage have been made during the year by various other governments, but they have not been of such dimensions as to materially influence the course of the market.

"In the Straits Settlements a reduction in the weight of the dollar from 416 to 312 grains was made, while the fineness was left unchanged at .900. About £250,000 of old currency was sold during the year, partly in London and partly in India.

"It remains to be seen what effect the low prices for silver, as well as for such other metals as copper, zinc and lead, with which silver is so often found, will have upon the production, but in the past it does not appear that the total output of silver has been much affected by the prices of these metals. The Canadian output is increasing, and becoming a more important factor."

Coal in Chile

Consul Alfred A. Winslow, of Valparaiso, reports that the fuel question is being closely studied in Chile. It is becoming evident to the people that it is unwise to buy coal from abroad at high prices, including freights, when the country contains immense quantities of coal that on the average is only about 5 to 10 per cent. inferior to the best English coal. The value of the importations of coal for 1906 was about $7,464,531, gold, of which the United States supplied only about $69,722 worth, against England's $5,420,658. It is estimated that Chile has paid over $30,000,000 for foreign coal since 1900, which is a heavy drain on a country of but 3,500,000 people.

Less coal was mined in Chile during 1906 than in 1905, which was due to labor troubles and water getting into one of the largest mines, which extends far out under the ocean at Lota. Some fine coal deposits are found in the interior, 50 to 60 miles from the coast, which it is proposed to open up as soon as transportation facilities are provided, but this is not likely to be done within the next two or three years. It is thought there was more coal mined in Chile in 1907 than in any previous year, but yet not sufficient to meet the increased demand.

There is a good opening in Chile for American coal in large quantities. The price for coal is high, being from $8.50 for Australian to $10.50 for Cardiff, in cargo lots. Coal enters free of duty.

The New British Patent Law

Consul Albert Halstead, of Birmingham, reports that the new British patents and designs act became operative Jan. 1, 1908. This act makes compulsory the working "to an adequate extent" in the United Kingdom of patents having the benefit of the protection of the British patent laws, and will force the manufacture in the United Kingdom of many articles now made in the United States for export to the United Kingdom. It will bring work to British labor, and that is what it is intended to do.

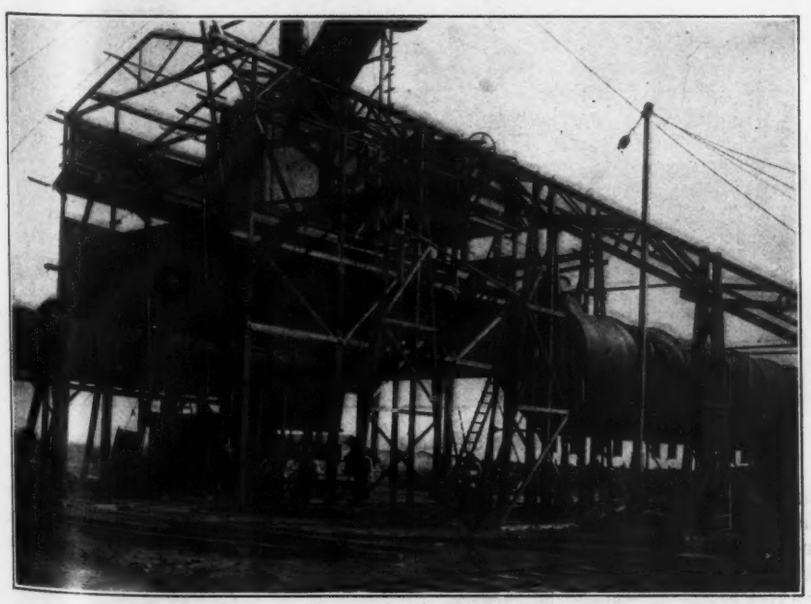
The Douglas Copper Smelter at Fundicion, Mex.

A One-level Blast-furnace Plant. The Charges Are Measured, and Raised to the Feed Floor by Bucket Elevators

BY PERCY E. BARBOUR*

The Southern part of the State of Sonora, Mexico, now has a modern custom smelter, situated at Fundicion, on the Cananea, Yaqui River & Pacific Railroad, about 155 kilometers east of Guaymas. This part of the State contains mines which have been operated almost continuously for 150 years; yet, until recently, it has been wholly without transportation facilities, except the burro; so that only bonanza deposits could be worked. The Cananea, Yaqui River & Pacific Railroad has now reached Alamos, the former capital of the State, connecting it with Guaymas on the Gulf of California and thence through Nogales, Arizona, with the United States. The development and exploitation of this rich mineral country is now apparently not far distant.

This smelter at Fundicion, operated under the name of the Compañia Metallurgica y Refinadora del Pacifico, is the creation of Theodore Douglas, of New York. It is being built primarily to treat the copper ores from the mines of the Douglas Copper Company, but incidentally it will be a custom smelter also, and thus afford the opportunity for handling the ores of many other properties in this vicinity. The plant, designed throughout by Mr. Douglas, has many novel features.



FURNACE AND FURNACE STRUCTURE

Ore Haulage

The transportation of ore from the mine to the smelter does not ordinarily form part of the smelter problem, but in this case it is interestingly otherwise. The mines are situated about 30 miles north of the smelter. The road lies over a flat, level plain for about 20 miles; the last five miles are up an easy grade to the camp at El Cobre. The ore will be brought from the mine to the smelter in wagon trains drawn by traction engines. Four "Holt" traction engines, especially constructed for this service at a cost laid down at Fundicion of $25,000 (Mex.), are used. One engine is equipped with a derrick. This was the first one shipped and it easily paid for itself during the construction of the smelter. The heavy machinery and engine parts were lifted by means of the derrick from the railroad cars and carried to and placed on their foundations without intermediate handling. Each engine will draw a train load, 50 tons of ore, from the mine to the smelter in one day. Heavier loads have already been hauled but 50 tons will be the regular duty.

BLAST FURNACE

The train crew necessary consists of three men: an engineer, a fireman and a brakeman. Wood is used for fuel. Water is secured from wells sunk along the route, pumped by low duty Cameron pumps, steam for which will be taken from the engines themselves. The total time for taking water, from the arrival of the train at the well until its departure is 12 minutes.

The ore is carried in sheet-steel tanks of a capacity of four tons each, three tanks being carried on each wagon. At the mine 20 minutes is required to load the train with ore, fuel and water for the down trip.

On arriving at the smelter this wagon train runs along the side of a small ore bin and the tanks of ore are lifted from the wagons and dumped into the bin by

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an electrically operated overhead traveling crane. The ore is then drawn out into a train of side-dump cars of the Kilbourne-Jacobs type and hauled up the trestle and dumped into the main ore bins. The narrow-gage, industrial railway, which serves every department of the smelter, is equipped with two Davenport locomotives.

Feeding the Furnace

The feeding scheme is another novel feature. The various ore bins are all numbered as usual; ore will be drawn from them into trains of cars running on the ground level underneath. These trains will go down one side and return by the other, thus always traveling ahead; this will keep them out of each other's way. The cars of this train are each divided into four transverse compartments, one each for coke, lime, iron, and ore. The charge having been calculated, the ore tender is instructed to fill the various compartments, from the specified bins, to the certain points marked by a gage in each compartment. Thus the charge is measured and not weighed and peon labor is sufficiently capable for the job.

The ore is dumped from these cars into a hopper forming the boot of an inclined bucket conveyer of the Jeffrey type, there being one at each end of the furnace, and is elevated to the feed floor where it is discharged into another large hopper, from which it is drawn into buggies and charged into the furnace. By this method the charge is thoroughly mixed before it is fed into the furnace, and this mixing is wholly incidental to the process and is secured without any extra handling or equipment. Each of these elevators has a capacity of 30 tons per hour. The arrangement is such that, with the addition of more furnaces, these conveyers can be made to feed directly into the furnaces, thus doing away with buggies and hand feeding.

ORE BINS

Furnace and Equipment

The present initial equipment includes a single water-jacketed blast furnace 44x 160 in. at the tuyeres and 13 ft. 6 in. from the tuyeres to the feed floor. The furnace stands on a stone foundation about 3 ft. high. The bottom of the furnace is a single plate supported by jack screws. The furnace has in all, 16 water jackets, made of pressed steel and without seams. The upper row of jackets consists of six, two on each side and one on each end. The lower row consists of two large jackets, and a narrow one on each side, the narrow one in the middle being short and having a small tymp jacket underneath. Each end has one jacket. An iron working-bridge surrounds the furnace.

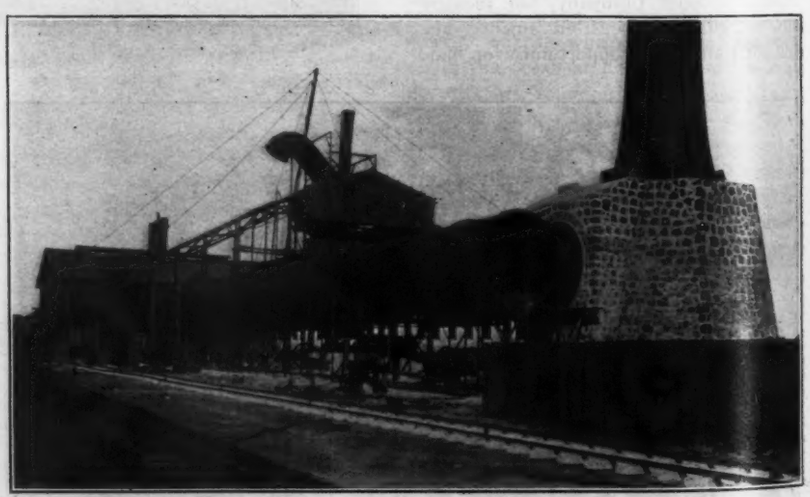
Blast is brought from the blower by a 36-in. spiral-riveted pipe, and is delivered to the smelting zone through 24 four-inch tuyeres, 12 on each side.

The slag spout is in the middle of the side of the furnace and pours into a round sheet-steel settler 15 ft. in diameter and 5 ft. high, lined with magnesite brick laid in magnesite clay. The matte pots have a capacity of 35 cu.ft. and the slag pots a capacity of 45 cu.ft., each. Both matte and slag pots are of the "Atlas" type.

The country about the smelter is flat, so that terraced construction of the plant was impossible, but just north of the furnace is a ravine and in this the converter plant, which will be installed soon, is to be located. This has two advantages. The matte pots will run from the settler to the converters, along the track, thus obviating the necessity of an overhead traveling crane, with the consequent increased building structure; and the fumes from the converter plant will be entirely removed from the furnace building. The converters will be of the tilting-furnace type instead of the usual Montana barrel converter.

The dust flue, constructed of steel throughout, is of the balloon type and is supported by steel columns high enough above the ground to allow a car to be run underneath, into which the flue dust can be drawn. The cross section of this flue-dust chamber has a minor dimension of 11 ft. and a major dimension of 14 ft. The length of the flue is 172 ft., and is connected with the top of the furnace by the usual circular cross-sectioned down-take.

The stack is of steel and is self supporting. It has a diameter at the bottom of 14 ft. and a diameter of 8 ft. at the top. It is 150 ft. high and stands on a 27-ft. stone foundation, thus giving a total hight of 177 feet.



DUST CHAMBERS AND STACK

Sampler

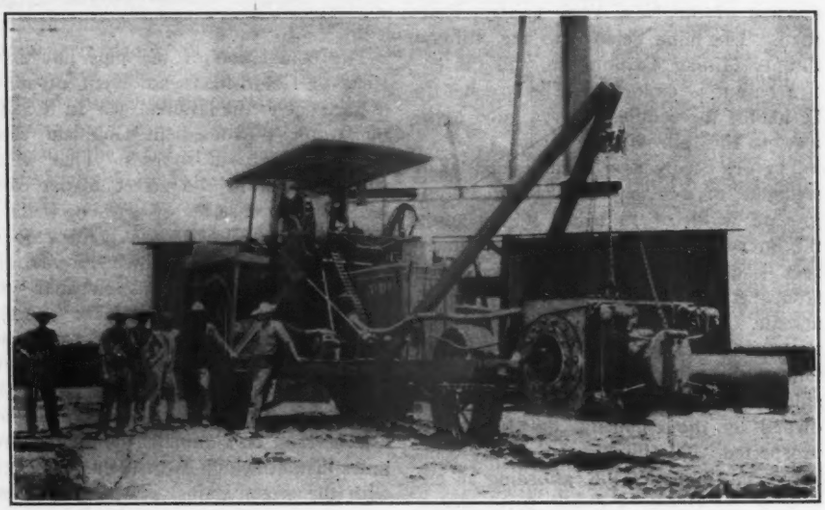
To obviate the necessity of building a large sampling mill another novel idea has been introduced. A Vezin sampler and an inclined bucket elevator, motor-driven, have been mounted on trucks to move along the narrow-gage railroad outside of the bins. The ore to be sampled

is put through this Vezin sampler which cuts out one-tenth and discharges it into the regular side dump cars which then go to the sampling mill. The rejects are discharged into other cars which are hauled up the trestle and dumped into the main ore bins. The sampling mill, thus much reduced in size, is equipped with a 42-in. Vezin sompler, one 15x9-in. Blake crusher, one set of 24x14-in. rolls and one set of 12x12-in. finishing rolls. The bucking room has a coffee-mill for fine grinding and a large electric heater for drying pulps. The sampling mill is driven by a 30-h.p. motor.

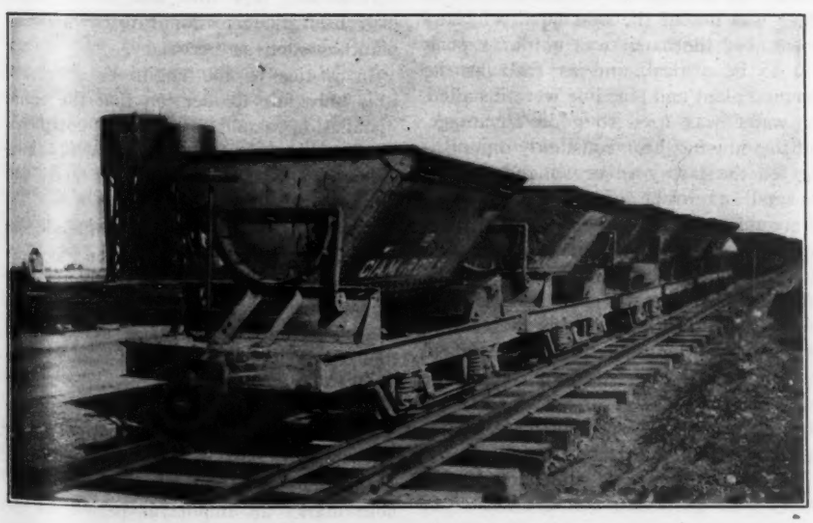
Fines and Flue Dust.

The method of treating fines, concentrates, and flue dust is also interesting. At the east end of the ore bins are small bins for these three materials, also for lime. These feed by spouts to the boot of an elevator which elevates the mixed materials and discharges them into a pug-mill on a platform along the bins and high enough to permit the smelter cars to pass underneath. As this material falls into the mill it passes through a spray of water and is then pugged to a stiff sludge. This sludge is fed to the furnaces in this form without drying or other treatment. The motor which drives the pug-mill will also drive the matte crusher which is located beside the matte sampling house.

The power unit to furnish current for all the motors about the plant is a Western Electric 75-kw. 550-volt generator direct-connected to a Bates-Corliss high-speed vertical compound engine, with 13-in. and 20-in. cylinders by 12-in. stroke. All the important lights around the plant are arcs connected in parallel, but with the switchboard wiring such that, in case of accident to the lighting unit, these lights can be thrown into series on the 550-volt circuit, and the plant will not be left in darkness.



HOLT TRACTION ENGINE WITH DERRICK LIFTING CORLISS ENGINE CYLINDER



TYPE OF CARS USED

Power Plant.

In the power plant every pipe and detail is above ground and easy of access; nothing is hidden.

The blast is furnished by a standard No. 9 Root rotary blower direct-connected to a compound-condensing, Bates-Corliss tandem engine with cylinders 12-in. and 24-in. by 36-in. stroke.

The lighting unit is a Western Electric 25-kw. 125-volt generator direct-connected to a Bates-Corliss vertical high-speed single-cylinder 9x10-in. engine.

The pumping system comprises three centrifugal pumps, direct-connected to electric motors, having capacities of 300 gal., 500 gal. and 500 gal. respectively, per minute, and one emergency centrifugal pump, with a capacity of 450 gal. per minute, direct-connected to a small vertical steam engine. The piping arrangement is on the scheme of bus bars on an electrical switchboard, so that any pump can be used for any service at any time. Water for the entire plant is secured from a well sunk on the property and cased with sheet-steel tubing 4-ft. 6-in. in diameter; it has a flow of 200,000 gal. per day.

Space has been reserved in the power plant for an additional blower with direct-connected engine; also for another electrical unit for emergency use.

The boiler plant has three marine boilers, 225 h.p. each, designed for a working pressure of 150 lb. Wood fuel is being used for the present.

The plant is equipped with a Wheeler condenser and a Cochrane feed-water heater and purifier.

Accessories.

The smelter has a well equipped laboratory and assay office, and in addition to a blacksmith, a carpenter shop and machine shop, a cupola is being installed for foundry work. When this is completed practically everything needed around the plant will be manufactured and constructed on the ground.

A lime-kiln will be installed and all the lime needed will be burned on the premises. This lime is extremely pure and low in silica and, oddly enough, carries considerable gold and silver.

Every building is so located and constructed that it can be extended in at least one direction without interfering with any other, so the plant's capacity can be easily and efficiently increased. From present indications it seems certain that the contiguous territory will soon furnish much more ore than this single furnace can handle.

The *Economist's* index number of average prices of commodities at the opening of January, 1908, is 2310, the lowest since March, 1906. This indicates an 11¼ per cent. reduction in cost of living since the opening of June, when the *Economist's* index number stood at 2601, the highest reported for any month or year since 1876.

An Arsenic Mine in Putnam County, N. Y.

By Edward K. Judd*

The only mine in the East that is now producing arsenic ore and, in fact, probably the only mine in the country that is now working for its arsenic value alone, is situated near Carmel, Putnam county, N. Y. This town is 50 miles north of New York City and is on the Putnam division of the New York Central Railroad. The mine belongs to the Putnam County Mining Corporation, and the entire output is exported. The ore has to be hauled three miles, over a good highway, to the railroad.

The ore occurs as a band, composed of stringers of arsenopyrite, having an aggregate width of 12 to 20 ft., including the intermediate barren parts; the country rock is gneiss. The ore, as it is hoisted from the mine, averages 10 or 12 per cent. arsenic. There are two such ore zones; these intersect at an angle of 60 deg. One of these has been developed to a considerable extent, while the other, not owned by the company, has been only prospected. The intersection of the veins lies at the foot of a hill, affording an excellent opportunity for adit development, of which, however, advantage has not been taken.

The present development on the company's property consists of a shaft, 100 ft. deep, from the bottom of which a drift runs for about 75 ft. along the zone of mineralization, which, at that depth, is said to have a width of 12 ft. No work has been done in the mine for some time, and it is now flooded, but material on the dump has kept the dressing works in operation until very recently.

Dressing

To concentrate the ore, it is first passed through a jaw crusher and then through rolls. The crushed ore is then treated in eight Joplin hand jigs. The screens of these jigs are made of cast-iron sectional plates, perforated with ¼-in. slots, very much like certain kinds of furnace grate bars. The only recovery of arsenopyrite is made from the hutch, and all the material remaining in the screen is thrown away. The capacity of one of these jigs is 4½ tons of crude or 1½ ton of concentrated ore per day. Labor for each jig costs $2 per day. The concentrate averages 25 per cent. arsenic.

This inefficient concentrating method has probably been justified by the fact that the market for the ore is not altogether regular, so that the whole plant not infrequently has to be closed down for weeks. It would seem, however, that a steam-driven plant should not only make a better saving of ore at a much less cost, but it would also involve little or no more loss in fixed charges, during a period of idleness, than the present plant. It is intimated that, after certain changes in management, the remaining ore, as to the existence of which there seems little doubt, may be mined and treated in a more economical way.

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New Water Supply for Goldfield

Special Correspondence

The completion of the pipe line from Lida to Goldfield is an event of much importance to the latter place. In the past the water consumed in Goldfield came from a variety of sources. That which was supplied in the street mains came largely from a series of artesian wells 13 miles north of town at a point 1200 ft. below the tank into which it was discharged. The water was elevated with two Deane horizontal-triplex pumps, working against a pressure of 750 lb. per sq. in. Part of the supply came from the Highland mine in Diamondfield, from which it was pumped and delivered into a large tank on Columbia mountain, three miles distant, which in turn was connected with the street mains, sewer system, etc.

About two years ago, the firing of a round of shots in the Highland mine opened up a large flow of water. The water was not of the best quality by any means, but the camp was not in a position to be critical, and as soon as the pumping plant and pipe line were installed, the water was used to good advantage. But the flow has been constantly diminishing for the last year or so and is now so small as to be of little importance. The company, therefore, is about to proceed with development work and exploit the quartz veins, which were discovered before the mine was flooded.

The task of bringing Lida water into Goldfield was undertaken by the Goldfield Consolidated Water Company, under the direction of Chas. G. Patrick as chief engineer, and L. B. Curtis and L. D. Galloway, consulting engineers.

The springs at Lida, which are now to supply Goldfield with water are located at elevations varying from 1000 to 2000 ft. above that of Goldfield and are thirty miles distant. The water is of excellent quality, and a series of chemical analyses have proved its purity beyond a doubt. A liberal stream of water has always flowed from the springs; but the natural flow was greatly increased by a number of adits, which were driven by the company. The combined flow from all of the adits is 800,000 gal. per day by weir measurement; this will all be supplied to Goldfield as soon as the camp needs it.

The work of developing the water and digging the ditch was commenced April 1, 1906, and by the end of the following June the thirty miles of ditch had been completed, the bulk of the work being done with teams. The ditch is of such depth as to cover the pipe under 2 ft. of earth.

Equipment

The line is constructed of 7-in. spiral-riveted pipe dipped in asphalt; the sheet iron used ranges in thickness from 14 to 18 gage, according to the pressure at different points, a factor of safety of six being allowed. In passing through a valley an inverted siphon 18 miles in length is formed; at the lowest point the pipe is under a pressure of 250 lbs. per sq. in. The joints of pipe are united by means of special cast-iron collars drawn together by bolts over a ring of cast iron which tapers in both directions from the center. A rubber gasket is used at each contact between the collar and ring. These joints have been found both economical and satisfactory.

It was found impracticable to grade the pipe line to deliver the water into Goldfield by gravity, so a pumping plant was installed two miles from the distributing tank. This installation consists of an 8x10-in. Gould's vertical-triplex pump, belt-driven by a 30 horse-power Westinghouse motor. This pump is designed to deliver 400,000 gal. of water per day against a pressure of 148 lb. per sq. in. This is only one-half of the capacity of the springs and pipe line, and arrangements have been made to duplicate the pumping plant as soon as necessary.

In justice to the engineers in charge it is only fair to mention that the entire installation would have been completed much sooner had it not been for long delay in replacing defective material and in freight transportation.

Until the outlying streets in Goldfield have been provided with service pipes the company will use a number of tank wagons which will deliver Lida water to the more remote sections at a reasonable figure. It is understood that the maximum charge for water through the service pipes will be 0.75c. per gal. and the minimum considerably less, the price varying according to the amount consumed.

The arrival of Lida water in Goldfield marks an important period in the development of the camp. It means improved sanitary conditions, greater convenience and reduced living expenses to every resident; and to the mills it means an improved extraction at a lower cost, for in the past the cost of water for milling has not only been excessive, but at times the quality has been such as to be detrimental to cyanide treatment.

Generally it is better to lower the water level in a well and thus increase the flow of water than to obtain a larger flow by spreading out the pumping equipment by sinking many widely separated wells.

Black Sands

By Arthur R. Townsend*

The failure of a company noted in the Journal not long ago calls attention once more to the difficulties to be overcome in extracting the values from black sands. The situation, as a whole, seems to be so little understood that it is not untimely to call attention to some of its principal features.

In the first place, it is proper to note that "black sands" often are not black and that the term "residual sands" would be more correct. In general, the phrase merely means the residue left in sluice boxes of placer mines and riffles of dredges which is encountered at the clean-ups. In the case of the company cited, they were attempting to treat the black or iron sand mixed with the ordinary quartz sand which was to be found on some of the California sea beaches. Such an operation probably made it necessary to handle a large amount of the original material in order to obtain a comparatively small amount of product. Under these condition, the difficulties of making a close saving are greatly increased. In every gravel or sand deposit, there is some black sand. In some cases, the quantity of this is small, and, in some, it is sufficient to render placer operations ineffective.

The efforts to save and treat black sands in the past have not succeeded and they have not been numerous. Their results have not been recorded. The literature on the subject is scant so that it is practically a new field. The best treatise that we have on the subject is the "Bulletin" of the United States Geological Survey written by Dr. David T. Day and Prof. R. H. Richards. At the time of the Portland Exposition, the Geological Survey established a plant at Portland to test samples of black sand. The results of testing about 1500 samples are recorded. The Survey has gone into this matter with characteristic thoroughness and the results, as far as they go, are reliable. About 8 per cent. of the samples noted assayed more than $100 per ton in gold; this fact is significant when one stops to consider the high stage of concentration represented by the residual sands of sluices and riffles. This investigation, however, only included one link in the chain of operations. It did not make clear one most important point, which concerns the conditions in which the gold occurs in the black sands. Is it free gold mixed with the sand or mechanically contained in the grains of the sand? It does occur as a chemical constituent of iridosmium, but beyond that, we have little information on this point. It has been stated that black sands leach well and yield their gold value readily to the cyanide solutions usually employed. If the gold is not mechanically contained, this would be simple enough, but it has been assumed by some that the gold is mechanically contained in the black sand and a process has been devised to extract it.

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Minerals in Black Sands

The minerals most commonly found in black sands, in the order of the frequency of their occurence, are given in the Geological Survey publication as follows: Magnetite, gold, ilmenite, garnet, zircon, hematite, chromite, platinum, iridosmium, mercury, amalgam, olivine and iron silicates, pyrite, monazite, copper, cinnabar, cassiterite and corundum. Many of these minerals have a market value by themselves and the work of Dr. Day and Professor Richards indicates the practicability of their separation with means now at our disposal. Tremendous quantities of sand and gravel are known to exist which contain some of these minerals, which are now valueless and which are available to anyone who chooses to locate them. When these facts are considered jointly, it is easy to see what an apparent opportunity there is offered to those that enter this field. Another consideration that stimulates investigation of the subject is the immense quantity of residual sand of undoubted value and in a high stage of concentration that is annually thrown away by the dredge and placer mines of the world. Any method by which this could be successfully treated would be a highly profitable enterprise.

Treatment of Black Sands

The proposals heretofore made to treat black sands have taken two general forms and are based on the two considerations offered above. They may be roughly classified as those that propose to mine the deposits, collect the sands and treat them; and those that propose to avail themselves of the second consideration offered and treat the residual sands now collected by the dredges and placer miners which are of no value because there is no method of treating them profitably.

One of the principal features of both of these classes of enterprises is the large quantity of iron that exists and which, after separation and briquetting, would make a desirable iron ore.

Mining and Separation

The operations attending any black sand enterprise are generally the following: The mining of the deposit, the separation of the heavy from the light sand and the separation of the valuable constituents of the heavy sand from the valueless ones. Briefly stated, the operation would be chiefly a concentration. Those ventures that contemplate the beneficiation of gravel or sand deposits of a type not heretofore treated, must include in the plans a solution of the difficulties attending the first operation. In most cases this can be done after some manner already tried and tested, such as hydraulic mining or dredging. Plans to treat beach sands for their content of magnetic iron might involve a variation of methods already tried; but at least this is not a new and untried field, and experienced engineers can say with reasonable certainty what could or could not be done.

Recovery of Value

The last operation, that of separating the valuable constituents in the concentrate from those of no value and from themselves, is not so easy. Professor Richards, in the Geological Survey publication above referred to, outlines courses of treatment for black sands that seem quite feasible. His name carries such weight that we are justified in assuming that the problem is capable of commercially successful solution. It is probable that the first efforts in the field would meet with a good deal of discouragement, from obstacles that were not anticipated because efforts in this direction have been few, and anyone who proposes to attacking the problem must anticipate such obstacles and be provided with funds with which to meet them, but it seems probable that the problem can be ultimately solved.

It is in the second operation that the great difficulty looms up. It is a practically untried field, and anyone entering must be prepared with resources, patience and time at his disposal. The problem is that of concentration of a very small bulk from a very large one. The valuable constituents might be 5 or 10 per cent. of the whole, but in most cases, they will not be 3 per cent. and are more likely to be 1½ or 2 per cent. Thus a concentration in most cases will have to be effected of from 33 to 50, or even more, into one. The existing stationary devices for the saving of gold from placer gravels, such as the sluice-box and riffles, are not capable of saving all the product and doing close work at the same time. They are undoubtedly well fitted to accomplish what they seek to do but, just as they at present save, comparatively speaking, a tremendous volume of sand in order to save all the gold, so also, if it were necessary to save all the black sand, it could only be done by saving a large quantity of white sand with it. With the appliances of which we have knowledge, it is not possible to save all the black sand and make a clean concentration. In any operation that contemplates the mining and treatment of gravel deposits containing black sand, the percentage of saving possible with the appliance to be used must be known. The amount of black sand saved at present in hydraulic and dredge riffles is extremely small; in most cases, probably a few thousandths of a per cent. of the gravel washed. Such a result furnishes us with

no clue to what could be done to recover black sands from gravel deposits. If any deposit of gravel were mined and put through a properly designed mill that would wash and exclude pebbles and boulders, classify the sand and distribute it according to size and in proper amounts on percussion tables, it seems reasonable to suppose that an excellent saving of black sands could be made. The possibilities of percussion tables were sufficiently demonstrated at the Portland Exposition. Such a mill would not be a profitable enterprise in connection with any gravel deposit that the writer is aware of, because of the tremendous amount of gravel that must be handled to secure a moderate tonnage of black sand. While it is known that percussion tables will make a good saving, it is also known that, in order to do so, they must not be crowded and can only handle a limited quantity of pulp.

Proposed Treatment

In order to treat a material of such little initial value as most placer gravels, we must employ a device that embodies the features of the placer miners' gold-saving appliances; cheapness of first cost, cheapness of maintenance and no cost to operate. Some adaptation of the sluice and riffles or the dredge riffles could probably be devised that would discharge periodically and which would make a very dirty concentrate, perhaps 15 per cent of the original material which would contain perhaps 90 per cent. of the black sand mixed with a large quantity of the light sand. Such a product would not in itself be of value, but it could be put through a wet concentrating mill embodying the well known features of such mills and adapted to such a case, which would then be making a concentration of something like 10 into one and would not be of extraordinary size. This could turn out a practically clean black-sand product which could then be treated for its valuable constituents as has been indicated at other places. Such an enterprise presents plenty of difficulties, most of which are caused by the low initial value of the material. Because of this, all the steps in its treatment must be made mechanically in order to be inexpensive. With regard to the hydraulic enterprises the greatest difficulties that present themselves are those in connection with the transfer of the dirty concentrate from the sluices to the concentrating mill. The latter, to be run economically, must be run continuously. Every concentrator man knows the importance of uniform feed and this appears to be one of the most difficult features to regulate. With a dredge delivering material at a fairly uniform rate, it should be possible, by enlarging the body of the boat, to install devices that would make the first rough saving economically and which would deliver to classifiers and percussion tables, on the same boat, the roughly concentrated sand from the first operation, free from boulders and pebbles and in such condition that it could be economically classified and concentrated. The concentrate would be of sufficiently high grade to bear the cost of transportation to some place better situated for the careful separation that would ensue.

Conclusions

The above suggestions are largely speculative, it is true, and anyone contemplating the solution of the problems in this hitherto untried field must be prepared for many failures at first. The ultimate success of all metallurgical innovations in the past has only been attained at the cost of many failures. From each failure we have learned some lesson and drawn some experience until at last the amount of inexperience was sufficiently small to be overcome at one time. These features must be kept in mind by anyone who would make the attempt.

Hart—A New California Gold Camp

Special Correspondence

Apparently the discoveries of new gold regions in the Southwest are not at an end. The latest is in San Bernardino county, in southern California, and has caused much excitement in the region and in southwest Nevada. Some of the ore found is exceedingly rich. The camp, which is named Hart after the discoverer, is nine miles from Manvel, or Bardwell station, on the Searchlight branch line of the Santa Fe railway, which brings it about four miles from the Nevada line. The first discovery was made by James Hart and partners in the last days of December, and by Jan. 10 a district was organized and hundreds of men began to flock in, most of them from Goldfield, Nev., whence the discoverers hailed. The ore is said to run from $60 to $200 per ton, while some of it goes into the thousands. The entire country within a radius of several miles is now being thoroughly searched by over a thousand miners and prospectors. At the discovered mines in the camp itself numbers of leasers are already employed.

Like other new camps on the desert, water is scarce, and it is said that $10 a barrel is paid for supplies, which have to be hauled 10 miles. Already, however, a pipe line is being laid to Malapai Springs to bring water. Development work is very active but, of course, the question of the permanency of the camp will not be settled for some time.

Small centrifugal pumps have been invented to operate in wells having a diameter of 12 to 18 in. These have developed an efficiency of 50 to 65 per cent.

British Metal Trade in 1907

The imports and exports of the important metals, other than iron and steel, for the full year are given by the Board of Trade returns as below.

Imports and exports of copper for the year were as follows, in long tons; the total imports giving the fine copper contents of all material:

	1906.	1907.	Changes.
Copper ore	96,249	103,749	I. 7,500
Matte and precipitate	74,875	71,950	D. 2,925
Fine copper	74,298	82,712	I. 8,414
Total copper	121,361	129,062	I. 7,701
Exports	42,370	49,529	I. 7,159
Re-exports	14,664	16,857	I. 2,193
Total exports	57,034	66,386	I. 9,352
Balance, imports	64,327	62,676	D. 1,651

The more important imports of fine copper in 1907 were 37,224 tons from the United States, 16,809 from Australia and 11,715 from Chile. The exports include copper in manufactured forms.

Imports and re-exports of tin for the year were as follows, in long tons:

	1906.	1907.	Changes.
Straits	35,635	35,296	D. 339
Australia	5,114	5,900	I. 786
Other countries	2,859	2,608	D. 251
Total imports	43,608	43,804	I. 196
Re-exports	32,271	26,761	D. 5,510
Net imports	11,337	17,043	I. 5,706

Imports of tin ores and concentrates were 20,672 tons in 1906, and 20,871 in 1907; an increase of 199 tons. Of the imports last year 16,455 tons were from South America.

Imports and exports of lead for the year were as follows, in long tons:

	1906.	1907.	Changes.
United States	18,394	27,314	I. 8,920
Spain	111,914	104,021	D. 7,893
Australia	54,272	50,150	D. 4,122
Germany	16,646	4,804	D. 11,842
Other countries	7,027	18,406	I. 11,379
Total imports	208,253	204,695	D. 3,558
Exports	44,895	43,319	D. 1,576
Balance, imports	163,358	161,376	D. 1,982

Nearly all the imports credited to the United States were of lead originating in Mexico, but refined here.

Imports and exports of spelter for the year were as follows, in long tons:

	1906.	1907.	Changes.
Spelter	93,704	89,327	D. 4,377
Zinc sheets, etc.	19,353	19,845	I. 492
Total imports	113,057	109,172	D. 3,885

Imports of zinc ores are not given in the reports.

Quicksilver imports and re-exports for the year were as follows, in pounds:

	1906.	1907.	Changes.
Imports	2,911,742	2,958,603	I. 46,861
Re-exports	2,078,439	2,209,939	I. 131,500
Net imports	833,303	748,664	D. 84,639

The imports are chiefly from Spain and Austria.

Imports of iron and copper pyrites were 759,324 tons in 1906, and 769,141 in 1907; an increase of 9817 tons. These imports are made mainly for the sulphur and not the metal values.

The Last of the Jersey Forges

By Edward P. Buffet

The mountainous country of northern New Jersey, chiefly comprised within the ancient diagonal line of "East Jersey," was, 200 years or more ago, found to be underlain by iron ores, the prospecting of which proceeded with so much zest that every principal vein now known is thought to have been discovered before the revolt of the colonies. In South Jersey, nearly co-terminous with "West Jersey," a distinct and parallel industry was developed from times probably even earlier, through the exploitation of bog ore. By the middle of the last century, the bog supply showed signs of exhaustion, but the lode mines in the north are extensively worked still.

Associated with these mineral deposits were ample forests, providing charcoal, and numerous streams furnishing power. To dam up a valley brook and start a forge, was a slight undertaking; in fact, it seems to have been chosen sometimes as a temporary expedient, to utilize the wood in clearing the neighboring land for agriculture. The bloomery forges, which made bar iron directly from the ore, antedated, and far out-numbered those more pretentious smelting furnaces which produced cast iron. These little bloomeries employed the Catalan principle, German type. According to tradition, some of them were blown by the *trompe*, or water blast, but what we know of these forge furnaces from their later examples indicates that the bellows was the prevalent source of wind.

Extent of the Industry

New Jersey was credited, in 1784, with 79 forges and eight furnaces, proper; in 1802, with 150 forges; and, about 1830, with 108 forge fires and 28 furnaces, 12 of the latter being blast furnaces and the rest foundries. We must trust that the statisticians properly distinguished between the number of "forges" and "forge fires." Two fires per forge were usual.

The old bloomeries constituted industrial establishments of almost as small and personal a nature as the cross-roads blacksmith shop. How petty the output must often have been, may be judged from the fact that the 150 bloomeries existing in 1802 had an annual production estimated to average 20 tons each, totaling 3000 tons. A ton a week per fire used to be regarded as a good output. One of the Fords, colonial ironmasters of Morris county, considered it an achievement worth celebrating when he "made and shingled a loop which weighed 28¼ lb.;" that is to say, when he drew from the forge furnace a 28½-lb. mass of iron and hammered it into a bloom.

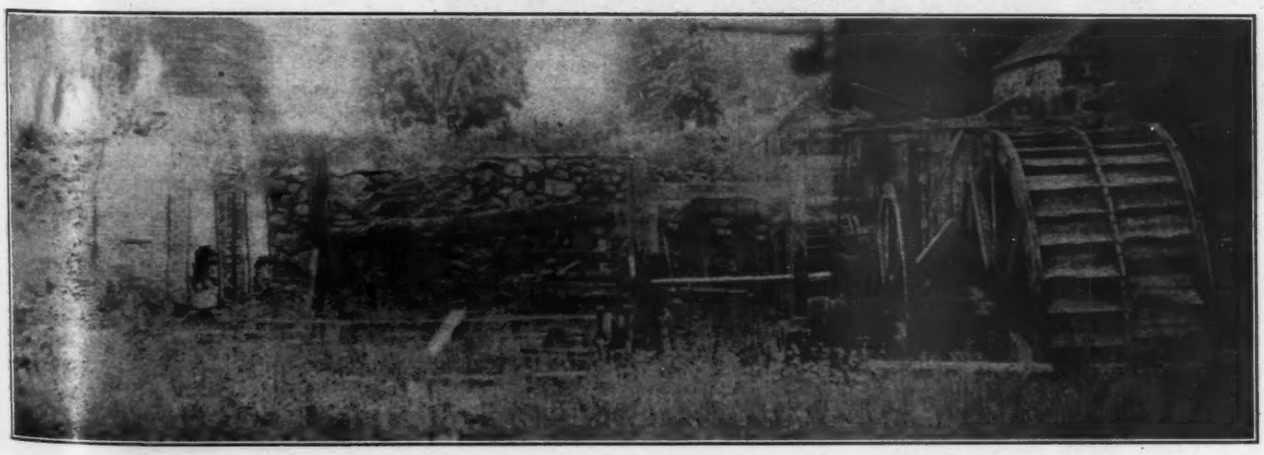
The product of the plants in this region used, according to tradition, to be transported eastward, over the Orange mountains, on horse-back, in leathern bags, the ore being brought from the mines in the same way. We need not assume that all of the forges worked directly from the ore. When associated with blast furnaces they doubtless were employed as refineries of the pig, and some of the others may have been used only to work up raw iron into finished products. Their characteristic function, however, was to manufacture bar iron by the independent process. Some of them served rolling and slitting mills, which turned out nail rods and horseshoe iron. Nailmaking, in early days, was a household industry, though manufacture by machinery was started in earnest before the close of the eighteenth century, and inventions along that line were numerous.

The iron works of New Jersey and the contiguous region in New York were employed during the Revolutionary war, upon army contracts, and captured Hessians were detailed for labor at some of the plants. An important line of work at the forges, down to the time they ceased running, was anchor making.

HAMMER HEAD, BURNT MEADOW FORGE, DENMARK LAKE

A Few Relics

On the Rockaway and Pequannock rivers and their tributaries, in and near Morris county, vestiges of the vanished industry abound, but generally these are limited to dams, overflows and the foundations of charcoal houses, more picturesque than informing. Riggs' "Swedeland forge," at Milton, shown in an accompanying illustration, was built, about 1797, by John Dow, Captain Cornelius Davenport and Jacob Riker. Colonel John Stanburrough came into possession in 1806, and ran it from time to time until his death in 1862. He once received from the Morris county Agricultural Society a silver cup, as a premium for making a ton of "octagon" iron in the shortest time. In 1862 Albert R. Riggs, having become the owner of Swedeland forge, reconstructed the building, and it was operated till 1870. The hammer anvil, which is shown in the illustration, is said to date



RUINS OF RYERSON'S FORGE, BLOOMINGDALE, NEW JERSEY

from the beginning, more than a hundred years ago. Hanging conveniently near is the lever by which the water was let on and off. A large beam is over the anvil and below it a shorter beam, which at first glance might be considered the hammer helve, but which really was the spring beam.

The hammer head, shown in another illustration, is the most conspicuous relic of Denmark, or Burnt Meadow forge, a few miles south of Milton. The existence of a forge at or near this place dates back to near the middle of the eighteenth century. It is earliest known as belonging to John Harriman and Sayre, but about 1768 was acquired by Colonel Jacob Ford, Jr., who died in the war time. Benj. Holloway bought the property and built the last forge in 1806, and subsequently it passed through various hands, falling, in 1858, into the possession of Ernest Fiedler. It

SWEDELAND FORGE, SHOWING ANVIL AND HAMMER HELVE, MILTON, N. J.

was used especially for the manufacture of anchors. Some distance below, on the east branch of the Rockaway river, a forge was established about 1749, and there a hammer head is preserved as a sort of monument on the land now used for a United States powder magazine. Still lower down, at Mount Pleasant, Colonel Jacob Ford, Sr., of Morristown, had "taken up," or located, the falls, in 1750, and built forges. Another forge, which remained in fair preservation until a recent date, though it is now dismantled, was Martin John Ryerson's, built about 1815, at Bloomingdale, on the Pequannock.

It was feast or famine with the old forgemasters. When bar iron mounted near $150 per ton, as in 1814-15, they could afford to build fine residences. Iron was such a predominant commodity of Morris county that a parish, when calling a minister, would sometimes reserve the right to pay him in that metal at 20s. or 24s. per cwt., as the value was variously estimated. The lingering death of New Jersey's primitive iron works, which was protracted over nearly half a century, resulted from various economic causes. Ultimately they proved unable to compete with outside plants, foreign and domestic, the Pennsylvania anthracite furnaces being one of the factors that told severely upon the charcoal furnaces.

A survivor of the local forge industry at Stockholm, N. J., a few years ago, whose recollection reached back about 70 years, remembered no case in which wind from falling water was used. A forge furnace would produce a ball of iron, weighing 250 to 350 lb., at welding heat, in three hours. This may have been after the installation of hot blast which, as he mentioned, came in about 1837. A local historian states that hot blast doubled the output for a given quantity of charcoal. It appears that bloomeries, as well as smelting furnaces, adopted hot blast. At one time the forge product had sold for 15c. a pound.

Slate Mining in Newfoundland

Consul James S. Benedict, of St. Johns, reports that two deposits of slate, suitable for roofing and other purposes, are worked in Newfoundland. The largest deposit is in Trinity Bay, and the product has been pronounced equal to the best Welsh slate. The colors are unfading purple and green. The other deposit is in Bay of Islands.

Belts for use on centrifugal pumps should be of extra width to reduce strain and to avoid tightness of the belt.

Transvaal Mining Notes

SPECIAL CORRESPONDENCE

The number of Rand mines contributing to the November output of gold was 66, made up as follows: Eckstein-Rand mines, 23; Gold fields, 5; Farrar-Anglo French, 5; Barnato, 7; Robinson, 5; Neumann, 4; Albus, 4; Goerz, 6; independent mines, 7. The total number of stamps at work during November was 8360, of which 2985 were under the control of the Eckstein-Rand mines interests.

The labor position for the month was satisfactory. Although there was a loss of 4610 Chinese in November, sufficient Kafirs were found to take their places. For the immediate present no great trouble is expected in finding Kafirs to replace the departing coolies. How it will be in a year's time it is difficult to say.

For November there were three mines producing 20,000 oz. and over, while 20 companies produced 10,000 oz. and over. The leading companies on the list were the Robinson, with 25,307 oz., the Simmer & Jack with 24,210 oz., and the Robinson Deep with 20,621 ounces.

As the end of the year draws nigh, the mines are announcing the payment of dividends. This has had a steadying effect on the share market and many of the dividend paying shares have gone up a few points. The severe depression has brought down the prices of many shares to a fair basis, and in some cases people can buy shares today with the prospect of getting a decent return on their money. The prices of Rand mine shares since the war have been ridiculously high, and these "hard times" are bringing them down to their true level.

The reaction against diamond shares has set in, and as the outlook for the sale of diamonds in America and other places is not cheerful, on account of the depression, the demand for diamond shares has fallen away considerably.

With the fall in the prices of copper, lead and zinc, the base metal industry in the Transvaal is depressed. There are one or two propositions which, with favorable prices, might develop into really successful mines.

The *Engineering Record* describes the largest automatic ore-weighing machine yet constructed, which has been shipped from England for use by the Canadian Northern Railroad at Parry sound. The capacity is 800 tons per hour and the machine is served by a 36-in. conveyer running at a speed of 600 ft. per minute.

It is reported in *L'Echo des Mines* (Oct. 24, 1907), that the manufacture of peat fuel by the government of Switzerland was abandoned on account of the poor quality of the product and the unsatisfactory price.

Gold Mining in Alaska*

By A. H. Brooks†

Various unfortunate conditions led to such a curtailment of gold mining in Alaska during the summer of 1907 as to result in a material reduction in the gold output as compared with that of the previous year. The preliminary estimates indicate that the value of Alaska's entire gold production for 1907 will be between $17,000,000 and $18,000,000, as against more than $21,000,000 last year. This loss must be charged for the most part to the decrease in the production of the placer mines. However, all the evidence points to the conclusion that a greater annual production than that of 1907 will yet be attained. The mining industry has therefore received only a temporary setback, but it is one from which it may not recover in less than a year or two.

The curtailment of placer operations can be assigned to certain definite causes, of which the difficulty of obtaining adequate labor is the most important. The Fairbanks district is the one that suffered most from labor troubles. A strike was started there on April 27, just when the gravel accumulated by the winter mining operations was ready to be sluiced by use of the water of the spring freshets. As a result many of the winter dumps were not finally washed out until fall. This not only prevented the mine operators from continuing work, but also put many of the smaller operators into financial difficulties, because they had counted on the winter production to finance the work during the summer. Labor conditions in the camp gradually adjusted themselves during the summer, but throughout the open season there was lack of experienced miners. When the strike began about 1200 men, it is said, left Fairbanks, most of whom started for the newly discovered Innoko district. As a result very few new enterprises were begun and many of the established mines were not operated during the summer. Had there been laborers enough the Fairbanks district would no doubt have produced more gold in 1907 than it did in 1906. As a matter of fact its production was probably $3,000,000 less than it was in the previous summer.

Developments of the Season

Among last summer's important developments were the noteworthy production of Esther creek, the opening up of considerable placer ground on Vault creek, and the discovery of prospects on Eldorado and Our creeks. These discoveries, together with those on Smallwood creek, indicate that the Fairbanks district proper is more extensive than had been previously supposed. The finding of gold in an adjacent area, on the upper Chena river, is also significant, as this region appears to lie in the same general belt as the Fairbanks district.

The railroad from Fairbanks has now been extended to the mouth of Cleary creek, and this road and the numerous wagon roads that have been built make all parts of the district accessible. The high charges on freight from Puget Sound ports and the uncertainties and delays in its delivery still greatly discourage all mining enterprises.

Important developments were made in the Rampart district, notably in its southern part on the tributaries of Baker creek, where two ditches were built and some successful hydraulic operations were carried on. Noteworthy, too, is the installation of three dredges in the Fortymile district. Two of these were in operation for a part of the season.

Some excitement was caused by the discovery of placer gold at several points on the lower Yukon. While no great values were found, yet these localities are so accessible that they give promise of being mined at relatively low cost. The two largest stampedes of the season took place to the Chandlar river and to the Innoko. In the first locality at least one producing creek was developed and some good prospects were found at other localities. Of the Innoko less definite information is available. More than a thousand people took part in this stampede, and many claims were staked, but little systematic prospecting was done. The region is rather difficult of access, being several hundred miles from the Yukon by the Innoko river route. Some gold has been found, but it is too soon to predict what the future of this camp will be.

Seward Peninsula

Seward peninsula also had its labor troubles during the past summer. Though they were not so serious as those of Fairbanks, yet they considerably hampered mine operators, and as a consequence the production will probably be less than it was last season. The old beach lines continued to be the center of mining activity, though much of their extent has now been mined out. The second beach line has been traced east of Nome river to Cunningham and Hastings creeks. The third beach line has also been traced to Hastings and has been found west of Snake river at Sunset creek. There can be no doubt that the discovery of these rich beach placers has retarded the development of more extensive but less valuable creek and tundra placers. These ancient sea beaches have proved to be so very rich that mine operators are disinclined to spend their activities in preparing to work the lower grade deposits of other forms of placers. As a consequence, there has been but relatively little creek mining during the last two years in Seward peninsula, especially in the vicinity of Nome.

In the northeastern part of the peninsula two long ditches, one at Candle creek and one discharging on the Keewalik, were completed. Considerable mining was done in this part of the peninsula, notably on Candle creek. The Taylor creek and some smaller ditches in the Kugruk district were also completed and were in part in operation.

The dredge on Solomon river has been in operation throughout the summer, as has also one near the mouth of Ophir creek. A smaller dredge has been operated on West creek, and a large dredge was constructed for mining on Bourbon creek near Nome. Gold dredging will undoubtedly become important in the peninsula. Plans are under way for utilizing water power and reducing the cost of operating the dredges.

Additional attention has been given to lode prospecting during the past summer, especially in the Nome district. Copper, lead, bismuth, antimony, and gold ores have been found, but it is too soon to predict an important future for lode mining.

In the Cook Inlet region, the most notable developments were in the Yentna district, discovered in 1905. Here the operators are for the most part small holders, but in the aggregate considerable gold was produced. Work continued in the placers of the Sunrise district, but there were no noteworthy developments. Interest was aroused by the discovery of mineral-bearing lodes in Kenai peninsula and in the islands and mainland to the southwest. Whether any of these are of commercial importance remains for the future to decide.

Railroads and Coal

The railroad situation in this part of Alaska has been the focal point of public interest throughout the summer. Construction work has been actively pushed by two companies building from Katalla, the immediate objective point being the coal deposit lying about 25 miles inland. In midsummer construction was also begun on a railroad from Valdez. All three of these roads claim to be building into the copper belt of the Chitina region.

Little has been done in the Alaska coal fields except to make surveys with a view of obtaining title to coal lands. The Controller Bay field will be opened up as soon as railroad transportation is established, and the same may be said of the Matanuska field.

In southeastern Alaska labor conditions again have trammeled mining operations. The Treadwell mine was closed for about three weeks early in the summer because of a strike, and the small operators have been affected to a lesser degree.

*From a bulletin of the United States Geological Survey.

†Chief of the division of Alaskan mineral resources, United States Geological Survey, Washington, D. C.

Producer-Gas Power for Smelting Works

By Walter E. Koch*

It seems to me that we are not making use of all the possible economies provided by modern invention and research in our copper and lead smelters. One of our leading mechanical engineers, lately returned from Germany, told me that he considered the producer-gas and engine plants in use there so vastly more economical and efficient than the best steam plants, that he could not understand why we kept on in the old, expensive way. He said the matter could not be regarded as a case of small saving, for an economy of 30 per cent. and upward is the rule. With this my own experience coincides.

The cost of installing a gas producer and engine plant is now very little, if anything, above that of a first-rate, economical steam plant, and the saving of labor is often important, for fire-men and boiler-tenders are not required where no boilers are used, and any ordinary man or lad can run a simple gas-producer plant. Gas producers can be shut off and held a long time, and there never need be a waste of gas, as there often is of steam; besides, a gas plant is far easier to handle. Beyond these well known advantages, there are others which perhaps are not quite so obvious.

Special Advantages for Smelting Works.

The coke supplied to furnaces contains fines and dust which are quite useless, if not actually prejudicial, in a furnace; these substances can be charged into gas producers and utilized to good advantage. The exhaust gases from the gas engines may be led into the blast-heater, if in use, to help heat the blast; or they may be led into the dust chambers, flues, or the base of the stack, and thus be made to serve two purposes. The exhaust gases used in this way will increase the draft so that a lower and cheaper stack can be sued; and the carbon dioxide and other spent gases will so dilute the sulphur fumes and furnace gases, that the effect upon vegetation will do little or no damage. This seems to me to be a practical and economical solution of the fume difficulty. If water is carried away in the exhaust, it can be easily drained off. There is no cheaper way of heating the blast above the temperature obtained from the furnace waste gases and gas-engine exhaust, than by the use of producer gas. Moreover, unless a very high temperature is desired, the producer can be charged with flue dust or fines mixed with lime or other fluxing materials. The producer if run hot will convert the mixture into a slag in excellent condition for smelting in the furnace. Since the gases are of no value except for heating, the producer can be run as an oxidizer or reducer as required. I tried this years ago, and with a small steam or air blast it did good work on lead and other sulphide fines, agglomerating them very well.

I have always found the simplest form of gas producer the best. The gas plant and engines should naturally be placed in a central station and used to generate electric current for distribution as required.

*Mining and metallurgical engineer, El Paso, Texas.

German Iron Production

The pig-iron production in Germany in November is reported by the German Iron and Steel Union at 1,112,225 tons, a decrease of 26,451 tons from October. For the 11 months ended Nov. 30 the total was, in metric tons:

	1906.	1907.	Changes.
Foundry iron	1,928,417	2,063,069	I. 134,652
Forge iron.....	786,752	717,949	D. 68,803
Steel pig.....	862,983	947,891	I. 84,908
Bessemer pig.....	439,987	432,517	D. 7,470
Thomas pig.....	7,390,290	7,777,959	I. 387,669
Total.....	11,408,429	11,939,385	I. 530,956

The chief increases were in foundry iron and in Thomas, or basic, pig.

Imports and exports of iron and steel in Germany, 11 months ended Nov. 30, in metric tons:

Imports:	1906.	1907.	Changes.
Iron and steel.....	592,655	741,168	I. 148,513
Machinery.....	75,940	82,004	I. 6,064
Total.....	668,595	823,172	I. 154,577
Exports:			
Iron and steel.....	3,324,313	3,170,654	D. 153,659
Machinery.....	269,314	302,517	I. 33,203
Total.....	3,593,627	3,473,171	D. 120,456

Excess of exports, 2,925,032 tons in 1906, and 2,649,999 in 1907; a decrease of 275,033 tons.

Utah's Coal Production in 1907

By Lewis H. Beason*

The year 1907 was the most active in the history of the coal-mining industry in the State of Utah. A total of 1,967,621 tons were mined, which is a gain of 128,432 tons over the production of 1906. Carbon county led in production by an output of 1,815,133 tons; Summit county came next with 73,918 tons; then Sanpete with 4500 tons; Morgan with 425 tons and unclassified mines in Iron and other counties with 70,117 tons.

In the annual report of the State inspector of coal mines, J. E. Petit, to the governor which was filed on Jan. 5, the total production of hydro-carbon is given as follows: Gilsonite, 21,462 tons; elaterite, 125 tons; tabbyite, 100 tons; asphalt, 4000 tons; ozokerite, 1562 tons; coal, 1,967,651 tons; coke, 324,692 tons.

Labor troubles were experienced in only one small camp in Summit county at the property of the Weber Coal Company; but the difficulty was of brief duration and production was interfered with for only a few days. The nationality of the men employed in the mines is summed up in the following: Americans, 1032; Greeks, 614; Italians, 428; Austrians, 392; Finns, 142; Germans, 48; French, 20; Belgians, 11; Swedes, 23; negroes, 8; Japanese, 56; Chinese, 1; or a total of 2687.

As a result of the exceptional demands made on the mines for fuel during the latter part of 1906 and the early part of 1907, it was with the greatest difficulty that the demands were met. New mining and smelting enterprises, sugar factories and other classes of industry displayed such prosperity that the coal mines and the railroads could not keep pace with the general activity. This condition led to the formation of a number of new companies, the more important of the number being the Independent Coal and Coke Company, which has opened a producing mine at Kenilworth, Carbon county; the Peoples' Coal and Coke Company, at Hales, is another and the Sunshine Coal and Coke Company and the Utah Steam Coal Company, at Coalville, Summit county, are others. During the year 2000 acres of ground were filed on and the amount of coal sold in Salt Lake City for domestic consumption amounted to 285,894 tons.

Wages of miners were increased in all the camps from 10 to 20 per cent. There were a total of 90 accidents to miners during the year, eight of which proved fatal. In the operation of the mines, 217,152 lb. of black powder and 108,059 lb. of giant powder were used. The average production of coal to the man was 712 tons.

*Special correspondent, Salt Lake City, Utah.

Analysis of Ferro-chrome

G. Gallo has found (*Gaz. Chim. Ital.*, 1907, Vol. 37, i, p. 450) that if a 15 per cent., weakly alkaline, solution of potassium chloride is electrolized in the presence of chromiferous iron, the iron will be precipitated as $Fe(OH)_3$ while all the chromium will go into solution as chromate. A platinum wire is used for the cathode. About 15 c.c. of the chloride solution should be used for each 0.10 gram of metal. With a current of 0.5 ampere and 8 to 10 volts, one gram of metal can be put into solution in four hours. When the electrolysis is complete, the solution is filtered, with washing, and made up to any desired volume. To an aliquot part, acidified with hydrochloric acid, potassium iodide is added, and the chromium determined by titrating the liberated iodine with sodium hyposulphite.

Functions of the Consulting Mining Engineer

By Employing Them as Non-resident Managers, Small Mining Companies Can Obtain Efficient Management at Small Cost

BY ALLEN HASTINGS ROGERS*

There are many engineers in this country who call themselves consulting engineers, and as such they are prepared, as their title implies, to be consulted on engineering questions. Referring more particularly to the consulting mining engineer, his functions do not seem to be understood in their entirety in this country, and it does not appear improper to venture a short description of the service which he offers.

It is rare that the consulting mining engineer is called on for any service other than the examination and valuation of mining property for prospective purchasers, but this, while one of his most important, is far from being his only field of work.

The examination and valuation of mining property for purchase is, of course, a very important work, and, since large amounts of money are usually involved, the engineer's position, as the representative of the purchaser, is one of great trust. But it is almost invariably for the purchaser that the engineer acts. Vendors of mines do not, as a rule, call upon the consulting engineer for a report on the basis of which to present their property. This, in my opinion, is a great mistake on the part of the vendor. For there is nothing that can awaken interest in an enterprise as much as a proper report on the property. Those commonly presented are worthless in that they fail to give much important information, and what is given is usually in such general form as to awaken suspicion as to its accuracy; in fact these statements often prove on analysis to be inconsistent and sometimes even contradictory. The width and assay value of the ore and the tonnage developed may be stated, but if, by chance, any detailed figures are given, they will generally be found to fail entirely to support the general statements.

Preparation of a Property for Sale

No one is likely to spend several thousand dollars in the examination of a property, the description of which, on reading, leaves a feeling of distrust. Owners would further their own ends if, on offering their property for sale, they first invested a little money in a good report, accompanied by assay and other maps, thus showing that the property is worth the price asked. Besides, a great many owners have not the faintest idea how to value their mines and, for fear of selling too cheaply, put a price on them which is prohibitive, and thus spoil the chance of a sale. The consulting engineer, representing the vendor, is just as capable of fixing a fair price for sale, as when he represents the purchaser.

While the fixing of the proper price, at which the purchase of a mine is made, is of paramount importance to the ultimate success of the undertaking, nevertheless, as soon as the property has been purchased, its economical operation becomes of as great importance. The valuation at the time of purchase is made on the basis of certain operating costs. If these costs are exceeded through inexperienced or inefficient management, the enterprise has as poor a chance of success as if it had been purchased at an excessive valuation. In England it is thought to be fully as important to obtain the best advice concerning the operation of a mine (and, concurrently, of information as to ore reserves, condition, etc.) as regarding its valuation for purchase, and it is commonly the custom to retain, for advice as to operation, the engineer on whose recommendation the property has been purchased.

In this country such is not commonly the case. Even the big exploration companies maintain an examining staff separate from their operating staff, and it often happens that, after the mine is purchased, the costs estimated by the examining engineer are not realized when the operating staff takes hold, either because the figures are impossible of realization, or because of incompetence on the part of the operating department. In the case of the independent companies, when the property has been acquired on recommendation of a properly constructed report by a competent engineer, the operation of the mine is often intrusted to an incompetent man and the examining engineer's recommendations are disregarded so that failure results, with, in many cases, unjust discredit to his judgment. This is mainly due to the desire of the directors to economize as much as possible, but also in some degree it is due to too much confidence placed in the so-called "practical miner." The desire for economy is laudable, but, when practiced at the expense of results, becomes folly, or worse.

Mistakes of Small Mining Companies

Nowadays it comes pretty near being true in almost every line of work that a man's ability is measured by the salary that he earns, and, while no doubt appreciating this, the directors, of what we may call the amateur mining company, argue that, as their operation is small, they cannot afford to pay a high salary for the management of a property employing, perhaps, 25 men. So they place their property in charge of a low-salaried man, who, perhaps, under competent direction may be well qualified to look after the details of the work, but who, without such direction, spends the company's money on such errors as driving long crosscut adits to gain hundreds of feet of depth on the strength of a surface-showing, but little, if at all, explored; who sinks shafts 200 or 300 ft. apart; who drives levels at 40 or 50 ft. intervals or buys tramways, mills or smelters entirely unsuited to the ore or of a capacity entirely disproportional to the capabilities of the mine.

But the consulting engineer, by making two or three visits a year to such a property can direct, in a general way, the development and save the owners from such expensive errors. His charges for such service would be relatively small, as it would consume comparatively little of his time. The large companies, each operating a number of mines, place in charge of all their operations a high-salaried man, who, by periodical visits and by correspondence during the interim, directs operations so that a much lower-salaried man may be employed for resident superintendent. One of the advantages gained by consolidation in any branch of industry, is that small constituent properties get the benefit of superior ability at small cost. But the small independent mining company can put itself in a position analagous to that of one of the mines of the big consolidation by retaining a consulting engineer.

Let us see what the consulting engineer would do under such circumstances. His work would be, according to the terms of his engagement, to act either as advisor to the board of directors or as non-resident manager. In the first case he gives advice, but only when called upon to do so, regarding any point which may be brought up. Such advice includes the decision as to the purchase of certain machinery or other equipment, the examination and criticism of an ore-selling contract, etc. Such service is rendered for a small retaining fee under much the same arrangement as lawyers are retained. In addition, it is frequently stipulated in such arrangements that the engineer may

*Mining engineer, 82 Beaver street, New York.

be called upon to visit the mine, if necessary to settle some question which may have arisen; in such a case a stated per-diem rate, in addition to his regular retainer, is paid him.

DUTIES OF A NON-RESIDENT MANAGER

At the other extreme is the full management of the property with full responsibility to the directors. The engineer's duties under such an arrangement are the same as those of a resident manager except that the carrying out of the details of the work, which he plans, are left to a superintendent on the ground, who may thus be a low-salaried man. He visits the property as often as the magnitude of operations and the speed with which the work advances require; he engages a man having his confidence as resident superintendent, who reports to him; he receives at frequent intervals reports and maps covering the progress of operations and so is enabled to issue instructions supplementing those given at his visits; he approves all important requisitions for supplies and equipment; he draws specifications for obtaining bids where necessary and, in fact, oversees in every way the operation of the property. He renders to the directors all information regarding the progress of operations and draws up for the annual meeting a report describing the work done during the year, the condition of the mine, the extent of the ore reserves and the outlook for the coming year.

The foregoing paragraph describes briefly the work of a number of consulting mining engineers in England but, except for the large companies, which take all the time of their general manager, I believe there are few such instances in this country. The number could be increased with profit to the mine owner. But the consulting engineer can be employed to cover any range of authority between none, as when he acts in purely an advisory capacity as described in the first case, and full authority as described in the last. I believe many people are ignorant that such arrangements can be made at reasonable terms, or if informed at all, they think it necessary to pay the enormous salaries we see occasionally reported in the daily press.

ERRORS AVOIDED BY EMPLOYING NON-RESIDENT MANAGERS

Although cited as one of the greatest errors which can be made in the development of a mine, one frequently hears of the erection of a mill or smelting plant before sufficient ore has been developed to warrant it. In a great many cases, even when the erection of a reduction works is warranted, the process or apparatus is entirely unsuited to the character of the ore, or the capacity is too large for the mine. There are two principal causes which tend to hasten the erection of a reduction plant—the desire of the owners to make the property pay and the desire of the machinery manufacturers to sell their goods. Both of these tendencies are perfectly natural. We cannot blame the owner for wanting to limit his investment to the smallest possible figure, nor for his desire to obtain dividends. He is perfectly right from his standpoint; the only error which he makes is that he decides to erect the mill on incompetent advice. Having decided to erect the plant, the catalogs of machinery companies furnish a variety of plans from which to choose and the machinery manufacturer does not inquire whether the plant which is ordered is properly adapted for treating the ore, nor whether there is sufficient ore to warrant its purchase and erection.

To avoid such errors, a mining engineer should be consulted. In the first place, he will tell the owner whether the condition of the mine warrants the erection of the reduction plant; whether the ore as then shown is likely to change its character with depth, and so render the mill erected for treating it valueless later; what process should be adopted for treating the ore, what capacity the plant should have, and furnish plans for the plant. If there is not ore enough developed to pay for the plant, it is folly to erect it, for the ore may give out. If the character of the ore is likely to change it would be foolish to build a plant until its permanent character is determined. The cost of this service is not excessively high and the insurance of success which it gives to the owner, instead of leaving the question to be decided by chance, is worth many times the cost.

In conclusion, then, it should be impressed on mine owners, directors and shareholders in mining companies that success is not largely a matter of chance, but that the surest road to success is to entrust the operation of the property to a man thoroughly qualified by technical knowledge, which has also been supplemented by a long experience. If they will employ such a man at resident manager, they are giving their property the best possible chance of a profitable outcome. But, if the operation is small, let them turn the technical management over to some well qualified consulting mining engineer as the next best course. Just as they would not turn the trusteeship of an estate over to a stockbroker's clerk, so they should not take the advice of the mine foreman when they invest large sums in adits, shafts or mills.

According to a paper read before the Pacific Coast Gas Association the smaller gas and gasolene engines require a heat input of about 14,400 B.t.u. to develop one brake horse-power; of this amount 11,855 B.t.u. are consumed in cooling, friction, etc., only 2545 being converted into useful work, which is a loss of 61 per cent.

Nitrate Production of South America

Consul Alfred A. Winslow, of Valparaiso, states that from 1830 until 1907 the nitrate fields of Peru and Chile have produced 36,443,327 tons of nitrate, valued at $1,112,728,765, gold. About two-fifths of this was produced during the last 10 years. There has been much said about the exhaustion of the nitrate beds, but from the best information obtainable they are good for 200 or 300 years, even at double the present production, which is about 2,000,000 tons per year. Fully one-half the production has been net profit. A new process has been invented recently that promises great things. Heretofore from 9 to 10 per cent. has been left in the waste, but with the new process it is claimed that the loss will be less than 2 per cent. and the cost of production will be less than by the old method. Even the former tailings can be worked at a profit.

Belt Conveyers at the New Kleinfontein

A note in the *Engineering Record* (Dec. 14, 1907) states that of the 17 belt conveyers used by the New Kleinfontein company in the Transvaal, the waste system contains five conveyers working in succession, the last two on top of a dump 130 ft. high. They handle an average of 1358 tons of waste rock, sand and ashes per day and are 30 in. wide. The longest is 454 ft. between pulley centers. The second belt runs horizontally in a deep cut for 110 ft., then rises to the surface and continues at an inclination of 19½ deg, to the top of a light steel tower 60½ ft. high. Between this tower and a similar but higher one, 195 ft. distant, the third belt is carried by two inverted bow-string trusses. A fifth belt is carried on a 164-ft. double cantilever of two trusses, supported at the center on a turntable carriage, which runs on a track 20 ft. from the edge of the dump. The belts are electrically driven, the speeds varying from 275 to 340 ft. per minute.

Ceylon Plumbago

Consul E. A. Creevey, of Colombo, reports that the first export of plumbago from Ceylon in 1825 was consigned to Joseph Dixon, the founder of the American Crucible Company, and from that time up to the present the United States has led all countries in the consumption of this product. The exports of plumbago from Ceylon in 1906 amounted to 35,183 tons, the largest export of any year in the history of the trade, and were to the following principal countries, in tons: United States, 15,495; United Kingdom, 9385; Germany, 6362; Belgium, 3201; France, 239; Japan, 130; Russia, 62.

Gold Dredging as an Investment

By A. C. Ludlum*

The last few months have witnessed a tremendous shrinkage in nearly all securities. In the last few weeks we have seen the culmination of a serious financial panic, which shook the public confidence to its very foundation, and taxed financial resources to their limit. In seeking investments today one is brought face to face with the perplexing question, "What investments, other than Government bonds, are safe and sure to yield a suitable return?"

We have unbounded faith in the magnificent resources of this country, and in its ability to meet all difficulties successfully; therefore the present problems will be solved in due course of time, and the nation will progress as prosperously as ever. But today, while we are facing these problems and seeking safe investments, it is well to consider the business of gold dredging as an investment that cannot be disturbed by any of the adverse influences which depressed the value of other investments in 1907.

Gold, the product of dredging, is not affected by any market conditions, except such as may make it more valuable. The gold dredge is self-contained; its cost is well known and it does not open a field for extensive manipulations by the over-ambitious magnate. The raw material (a sufficient number of acres of proved ground) can be secured, and its valuable content determined, and with the returns accurately calculated an absolutely safe form of investment is possessed. Panics, with their concomitant scarcity of gold, serve only to make this form of industry more valuable.

Nearly all industries are constantly threatened with over-production and consequent low prices. The prime reason for the organization of trusts is to prevent over-production and thus maintain high prices. In the gold-dredging industry over-production is not feared. The demand for gold is unlimited.

The modern gold dredge is a complete operating plant in itself, requiring only about 10 men under a manager to operate it night and day. It will handle from 2000 to 5000 cu.yd. of material per day, which is equal to 3000 to 7500 tons, washing all of this material, saving the gold therefrom and returning the exhausted gravel to its place. The cost of operation under favorable conditions is from 4 to 7c. per cu.yd.

During the recent financial disturbance we heard no cry of "curtailment," "retrenchment," or "plants closing down," in this industry. I have had, lately, many letters from the California dredging districts, to the effect that while California in general has been hard hit by earthquake, fire, political corruption and financial troubles, the dredging districts are more prosperous than ever. It is self evident that gold dredging is free from labor disturbances, when it be considered that labor plays so small a part in the operation of the dredge, the cost for labor amounting only to 1 to 1.5c. per cu.yd.

Dredging is a comparatively new industry in this country and the first few years were spent in developing the dredge of other countries to meet our conditions in experimenting with new types. Today finds the dredge crystalized into a type with variations only in details. This has also brought to the front experienced engineers with so specialized a knowledge of this subject that success can be assured after a careful investigation by such competent authority.

Modern methods of pre-determining the value of dredging ground are absolutely reliable; a dredging area may be prospected and the future returns from it can be predicted with exactness. If the property be equipped with a skilfully designed and well built dredge, the future is assured. One has only to produce and to continue producing, while a ready market awaits the output, with no question of credit or terms, and with no danger of panics, hostile legislation, or stock-market manipulations.

In considering this industry and looking about for an area of gold-producing gravel of sufficient extent, it is soon discovered that the known dredging fields in this country are well occupied and command a high price. In California, the best known dredging field in this country, we find a large number of dredges operating successfully and paying dividends, and the engineers of these companies are constantly on the outlook for new territory to which to extend their operations. Every effort is being made to reduce the cost of dredging, so as to enable them to work the poorer areas still remaining and obtainable. Much thought is being devoted to improve the design and strengthen construction of dredges, to enable them to work the more difficult ground, i.e., ground that is exceedingly hard to dredge and poor in value. All this is done in the anxious desire for more territory to which to extend a profitable industry.

Alaska offers a large territory for the serious consideration of dredging operators, especially wherever the area is covered by lakes or rivers, thus keeping the ground in an unfrozen condition. Such ground is easily dredged. Many dredges are in successful operation in this Territory, and many others are now under contemplation or in course of building.

Siberia is a promising field for future dredge operations, and much work is now in progress there. Mexico contains much dredging ground with many attractive inducements because of good climate, and generally favorable conditions. Considerable ground is now being prospected and dredges being installed, while others are in contemplation.

South America, with its great placer production that enriched the old world, is now attracting widespread attention. The next few years will see remarkable progress and large gold production from dredging operations in that continent. Dredges are now operating there, and many are under installation and many are under consideration. Numerous prospecting expeditions are now actively engaged in Colombia, Dutch, British and French Guiana, Chile, Venezuela, and Brazil.

That capital should seek gold-dredging ground in these remote and inaccessible countries proves the great demand for such property, and keen appreciation of gold dredging as a manufacturing enterprise.

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Oklahoma Gypsum Deposits

Charles N. Gould, professor of geology at the State University, estimates the amount of gypsum in the three regions of Oklahoma examined as follows: Main line of gypsum hills, second line of gypsum hills, and the Greer county region, 125,800,000,000 tons. There are at present eight gypsum mills in operation in western Oklahoma, whose output runs from 40 to 100 tons per day. Coal is the fuel used, the greater part coming 200 to 250 miles, the price at the mills ranging from $4 to $6.50 per ton. There are two problems to be solved in connection with the gypsum plaster industry of Oklahoma, namely, available gypsite deposits and cheaper fuel.

The plaster men believe that the greater part of the gypsite has been located, and that the supply will soon be exhausted, but Professor Gould says there is geological reason for believing that there are vast undiscovered deposits of gypsite in each of half a dozen of western counties, and that he is convinced after 10 years of careful study that, at a conservative estimate, not 10 per cent. of the available gypsite deposits have yet come to light. The fuel problem he considers more difficult. The geological structure of the gypsum region renders any expectation of discovering coal, petroleum, or natural gas futile. After discussing coal haulage from the nearest supply, 200 miles, he considers the most practical solution of the fuel question is to pipe the natural gas to the gypsum, as the gas mains are already laid to Oklahoma City, and will probably soon be extended to El Reno, which is not more than 15 miles from the southern end of the gypsum hills.

Chains and Cross-bars for Handling Mine Cars

Steel Bars across the Track Push the Cars over an Automatic Dumping Device to a Swing-lift Transfer

BY O. V. GREENE*

The original idea of handling and dumping mine cars as here carried out, did not include anything more than hoisting an empty car from its full dumping position on a plain horn dump directly to an overhead track, using a haul of some sort to accomplish this end. It became manifestly impracticable, if not impossible, to use an ordinary single-chain haul to do the work, so two chains were used, one on each side of the dump, having two pipe cross-bars attached at equal intervals in their length.

When the horn dump was at its full dumping inclination, the receiving end of the dump registered with a track directly above the loaded track, and one of these pipe cross-bars would engage with the low end of the empty mine car and push it up and over a knuckle upon the upper track. This was rather a crude idea, but it served the purpose of enabling the operator who put it in to reduce the size of his tipple and eliminate some of the men usually required.

A plan then came up embodying a slope to the coal lying about 35 ft. below the surface. It was decided to try applying this double chain and cross-bar idea with an upper and lower track, modified to suit the conditions imposed. As it finally worked out this idea developed into a conveyer of the endless double-chain variety, without the buckets, but with two additional parts, each a simple one-piece pivoted member operated positively.

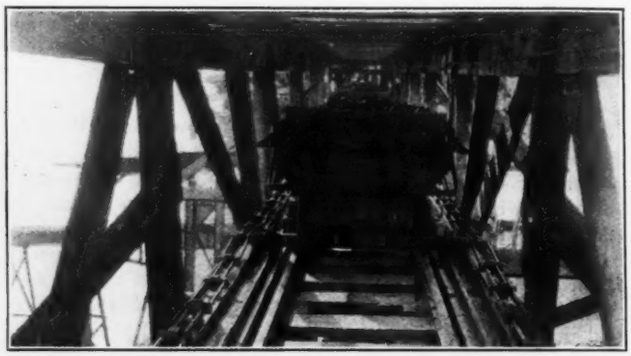
A detailed description of this car-haul conveyer as installed in accordance with this plan should naturally begin by showing wherein it differs from an ordinary car haul to suit the same conditions. Possibly the most marked distinctions at first glance would be in substituting double chains with cross-bars to engage the mine cars for the single chain with dogs; and in putting one track above the other, instead of placing the empty and loaded tracks side by side or parallel.

Method of Construction

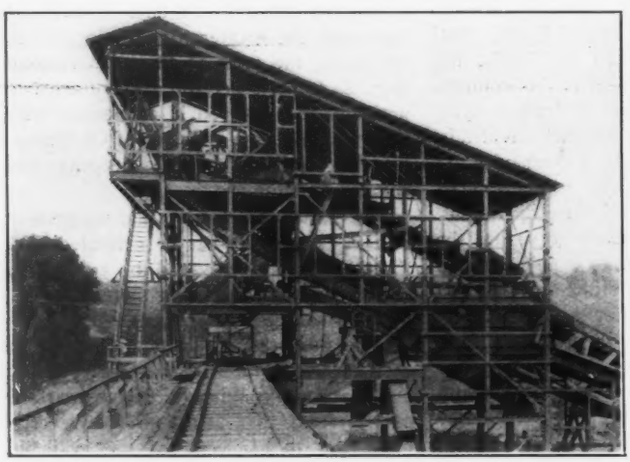
The chain used in the haul shown in the accompanying illustration is a Scranton drop-forge chain with 24-in. pitch and 1¼-in. pin. The cross-bars are of double, extra heavy wrought iron pipe 4 in. in diameter, with a welded and pinned stub in each end. In addition to being attached to the chains at intervals of 36 ft. the cross-bars run on wheels turning on the stubs.

The cross-bars on this particular haul engage with lugs placed on the bottoms of the mine cars, similar to an ordinary single chain haul, but in later hauls the

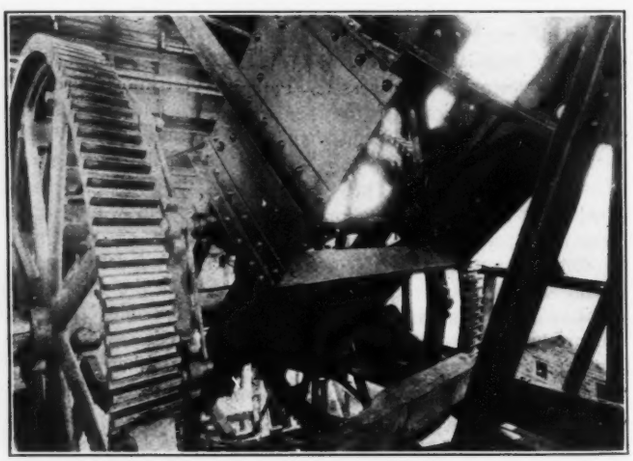
TRESTLE APPROACH TO TIPPLE SHOWING LOADED CARS ON LOWER RUNWAY



CROSS-BAR PUSHING CAR UP SLOPE. LUGS FOR RAISING GATE SHOWN NEAR TOP OF CAR



SIDE VIEW OF TIPPLE. SWING LIFT TRANSFER IS REGISTERING WITH LOWER RUNWAY, READY TO RECEIVE A LOADED CAR



CROSS-BAR SHOWN UNDER THE SWING LIFT TRANSFER HORNS, RAISING THE LIFT AS BAR TRAVELS AROUND DRIVING SPROCKET

*Mining engineer, Republic building, Cleveland, Ohio.

lugs are dispensed with entirely, the cross-bar lifting the rear end of the mine car bodily, supporting it up and down the slopes and through all its evolutions. By engaging the cars in this way, it is practically impossible for them to get away and cause the wrecks and delays associated with a single-chain haul where everything depends upon a dog's remaining in place against a lug. Then again, by merely elevating the cross-bar wheel tracks in relation to the mine car tracks, a car can be moved in a position, inclined only enough to prevent coal from falling off, and on a pitch of slope which would be considered prohibitive with an ordinary haul.

As shown in the illustrations, there are two sets of tracks and a chain guide on both the upper and lower runways of the haul. One track, the inside one, is for the mine car wheels, and on each side of this track, but using the same track center, are the rails of the cross-bar-wheel track, and still outside of the cross-bar-wheel tracks are the chain guides, channels or plain flat plate for the chain rollers to run upon.

A 12-lb. rail was used for the cross-bar-wheel tracks, and a 40-lb. rail for the mine-car tracks. The chain guides are either 8-in. channels or 6x¼-in. plates. The channels were used in this particular haul. The chains track over head and tail sprockets, as in any endless double-chain conveyer, and the driving mechanism is practically the same but larger.

In the plant of the Wheeling Valley Coal Company, here illustrated, the driving sprockets at the head of the haul are solid steel castings 10 ft. pitch diameter. The driving gears attached to these sprockets are solid steel castings 11 ft. in diameter, 8-in. face, driven by a train of cut-steel gears providing a reduction of about 300 to 1 from the motor speed.

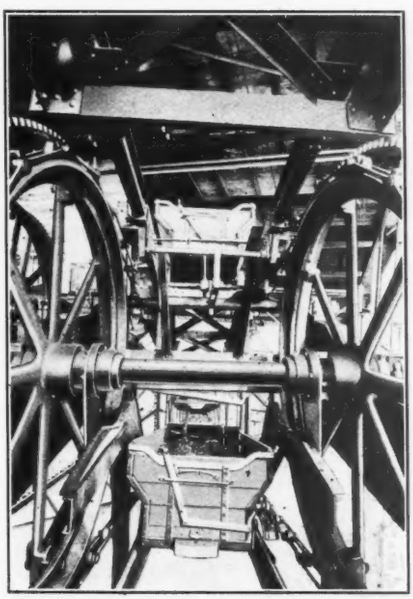
A 75-h.p. motor does the driving of both the car haul and the feeder at the bottom. When running full, the motor is handling 8 loaded cars 10,000 lb. each maximum, and 8 empties, on a 23 deg. slope, besides operating the feeder, which pulls 40 cars on a ½ per cent. grade in favor of the loads.

The maximum load on the motor occurs when the lower runway of the haul has its full quota of eight loads with no empties on the top runway, and the feeder full. The balancing action of the empties against the loads reduces considerably the power required.

Dumping Device

It is rather difficult to describe just how the loaded car is dumped and the empty car transferred from the lower to the upper runway at the head of the haul, in the tipple head frame, because no one operation occurs singly. The dumping action is entirely dissimilar to that associated with other devices. It occurs while the car is in transit.

The mine car, one of the usual lift-end-gate type of three-tons capacity, is taken up the lower runway of the slope with the end gate facing down or toward the mine. A couple of small lugs are fastened on each side of the lift-end gate, and when the car has reached a position directly over the dump plate in the tipple, these lugs come in contact with a suitably shaped set of rubbing plates placed on each side of the car, which causes the mine-car door to open wider and wider as the car proceeds up the slope. As soon as the car door starts to open, the normal pitch of the slope causes a partial discharge of the coal from the car. The full discharge is effected by the opening of the car door to its full extent, and the increase of the pitch of the car from 23 to 60 degrees. This increase of pitch is attained gradually, as is also the discharge of the coal, by the cross-bar's pushing the car upon the swing-lift transfer, forming part of the hauling mechanism at the top.



TRANSPORTING AND DUMPING MECHANISM. DOOR-LIFTER GUIDES ON EITHER SIDE OF LOADED CAR

In other words, the car is gradually drawn from under the coal, producing a spreading action over the screens, similar to that of a bricklayer spreading his mortar.

The Transfer

The swing-lift transfer is a single pivoted member, the free end of which describes an arc when it is lifted by the cross-bar from its normal position in register with the lower runway, to register with the upper runway. It again describes the same arc, but in the reverse, when the lift drops from the upper to the lower runway.

Taking up again the movements just after the car is on the swing-lift transfer; the car door is now wide open and the wheels on the cross-bar, pushing this particular car, have run under the horns attached to the lift. As soon as the cross-bar starts on its travel around the driving sprocket, the car door begins to close, the car moves a little further up on the swing-lift transfer, and the lift itself, together with the empty car, starts to rise. When the cross-bar has reached the furthest point up and out on the circumference of the driving sprockets, the car door is fully closed, and the cross-bar having passed this point, the car starts to run forward on the swing lift. By the time the lift registers with the upper runway, the cross-bar is about ready to leave the horns on the swing-lift transfer, and the car, now actuated by gravity, is ready to follow the bar off the lift and down the upper runway of the slope. However, the cross-bar does not leave the horns on the swing-lift transfer, nor does the car run off, until the free end of the lift is latched in register with the upper runway. This being accomplished, both the car and the bar perform the operations described, and the instant the car is clear of the swing-lift transfer, the cross-bar trips a trigger, which releases the lift latch, allowing the lift to resume its normal position in register with the lower runway, ready to receive another car.

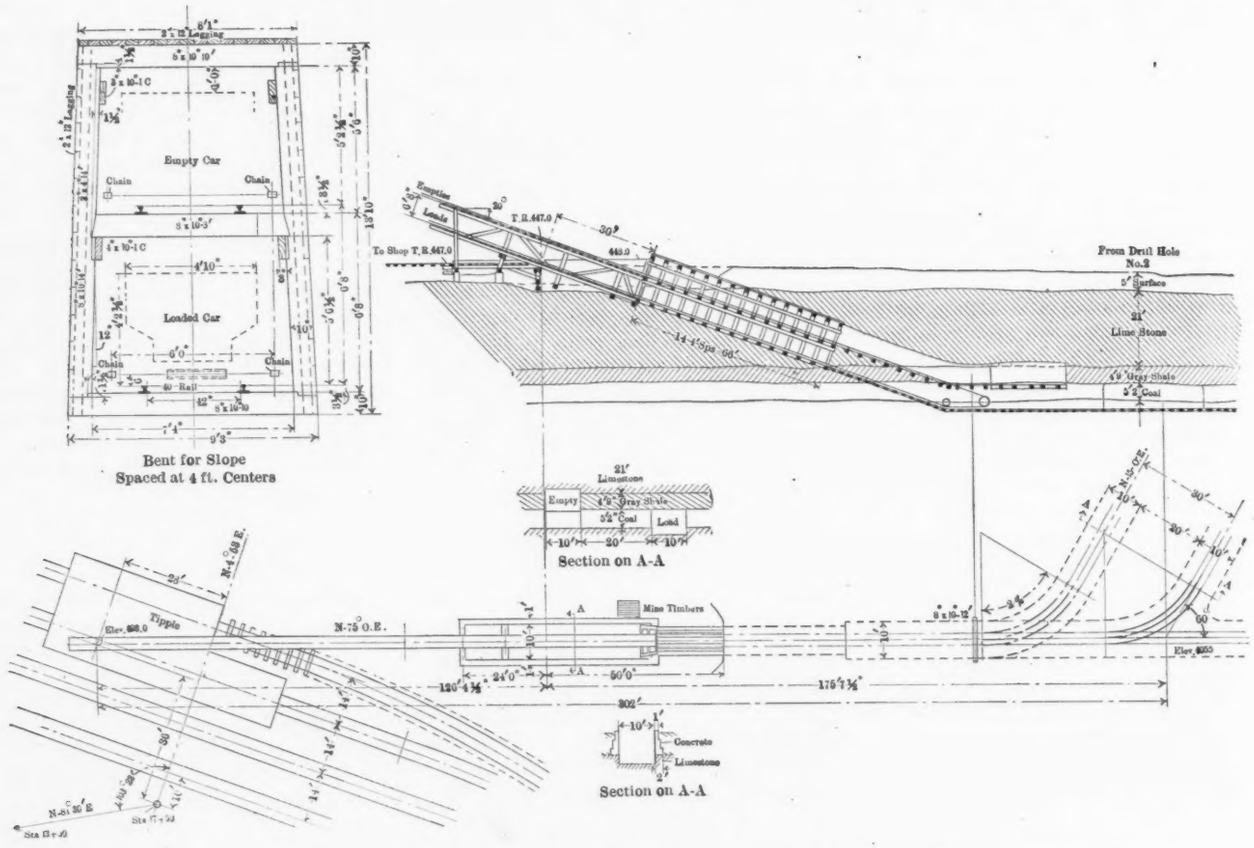
This swing-lift transfer is counterbalanced so that the shock in dropping from the upper to the lower runway is very slight. In fact this slight shock is the only thing that disturbs the absolutely smooth movements of the haul.

The many varying movements are so intermingled and so seemingly dependent upon one another that the apparatus may be inferred to be excessively complicated. This, however, is not the case. The chain is bound to travel its course around the head sprockets, and the swing-lift transfer is bound to rise as the cross-bars engage the horns. All the other movements are dependent upon these two simple, positive movements. The hand at the bottom equals in smooth running, easy action and simplicity of moving parts, the arrangement at the top.

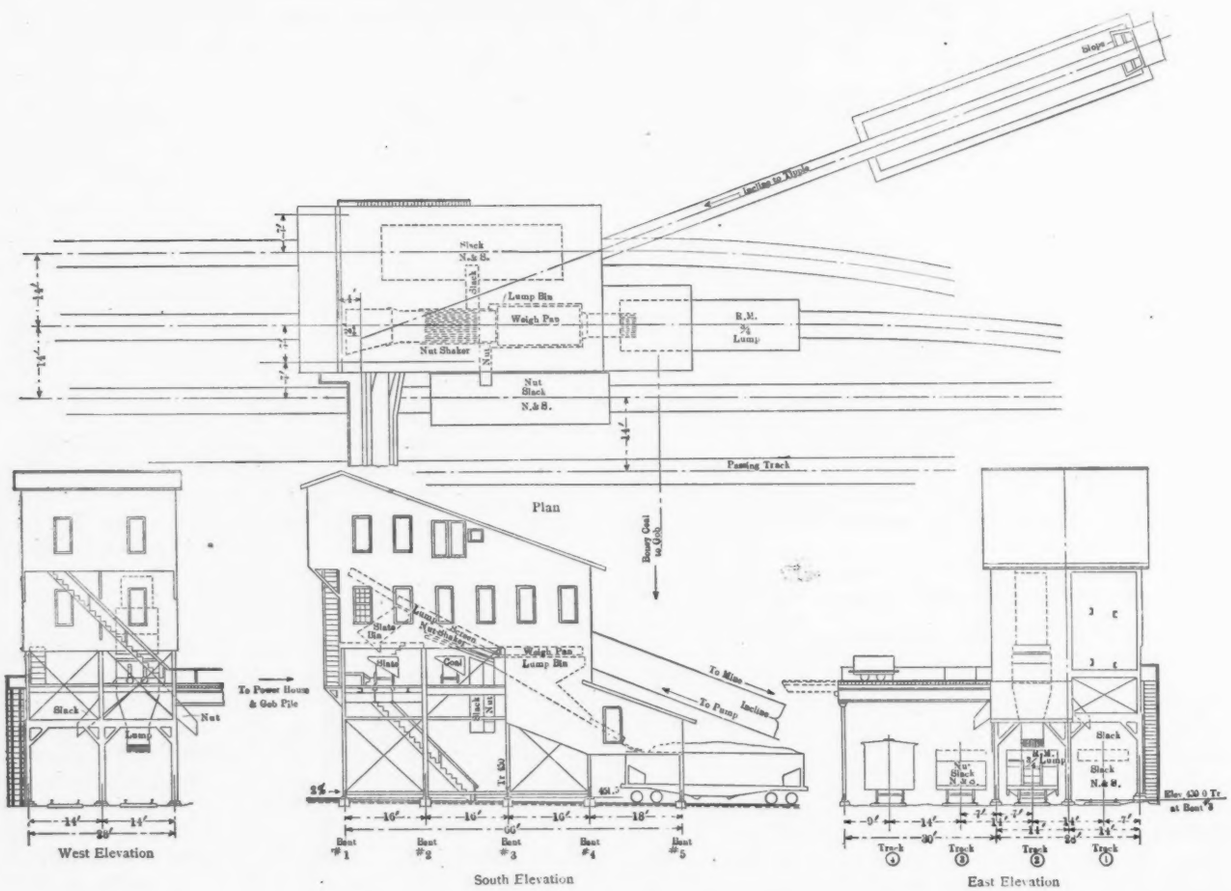
The loaded cars are positively fed into the haul, one at a time by the feeder, and in such a manner as to render it practically impossible for a cross-bar traveling around the tail sprocket to collide with a car and cause damage.

The Feeder

The feeder is a single chain running in the center of the loaded track, with two tilting dogs attached at equal intervals in its length. The dogs engage the lugs on the bottom of the cars, and while one dog is hauling the entire loaded trip along, the other, in front, is taking a detached loaded car and pushing it into the haul, immediately following a cross-bar. This loaded car stands in a pocket at the foot of the haul, until the next cross-bar comes



GENERAL DESIGN OF SLOPE FOR THE WHEELING VALLEY COAL COMPANY



GENERAL DESIGN OF TIPPLE FOR WHEELING VALLEY COAL COMPANY

along, when it resumes its travel up the slope. Meanwhile another load is being fed into the haul in the manner previously described. The feeder is operated by means of an auxiliary double chain and gear arrangement attached to the tail sprockets of the main haul. The travel of the feeder is thus a positive proportional part of the main-haul travel.

How the Cross-bar Passes Through the Track

The question has no doubt arisen as to how the cross-bar, which straddles not only the mine-car track, but also the cross-bar-wheel tracks on both the lower and upper runways, is able to get through the upper runway tracks, at the foot of the haul. The cross-bar cannot slip away from the lug on the car, in the manner that a dog does on a single chain haul, for the mine-car wheels would still strike the cross-bar. It is therefore necessary to stop the car to allow the cross-bar to run away from the lug and get through the track before the car is released, something after the manner of a flying switch on a railroad.

This operation is effected by no more complicated means than a single-piece pivoted track-gate that lifts in a vertical direction, the free end of which engages with the tread of the car wheels, forming the car stop. The cross-bar operates this track gate in a manner similar to that in which it operates the swing-lift transfer at the top.

The track gate is built up out of a ⅜-in. plate, having a short section of mine-car track firmly attached, with a hinge at one end. The plate is sufficiently wide to accommodate two horns placed on each side of the car track and of a gage to correspond with the gage of the cross-bar wheels. The horns are shaped so that when a cross-bar on its travel down the slope runs under them, they raise the track gate and consequently the car tracks, making a sufficient aperture for the bar to pass through.

As previously stated, the raised or free end of the car track engages the tread of the car wheels, stopping the car momentarily until the cross-bar gets through the aperture. The bar being through, the gate drops back to its normal position, permitting the empty car to run over the gate and upon the empty storage track.

Resembles a Conveyer Without Buckets

As will be noted, the only additional parts needed in this conveyer car haul not found in the ordinary conveyer are the swing-lift transfer and the track gate. Both are single-piece pivoted members, operated positively by the cross-bars. This upper and lower runway idea of the conveyer system can be applied with an efficiency and economy in handling and dumping mine cars impossible with the parallel-track system.

Dumps have been evolved that in addition to controlling the dumping of the coal absolutely, transfer the empty cars from one track to the other. These transfer dumps are actuated either by steam or gravity, or both, and handle the empty car without the need of any auxiliary tracks, kickbacks or switches.

Advantages of the System

The car haul conveyer, or self-dumping car haul, as it is called, serves either slope or incline operations equally well, and at a pitch in either that would be prohibitive with the ordinary single chain haul. It dumps into storage bins or tipple screens, or both, and receives the contents of the storage bins, discharging into the tipple screens with as much ease as in handling the loaded car direct from the mine to the tipple. Even in shaft operations, the upper and lower track idea may be incorporated in the cages, rendering unnecessary the usual car lifts, hauls, etc., for handling the empties at the shaft bottom.

The slopes are all of double hight instead of double width, in order to accommodate the upper and lower runways, and the trestles are all double-decked instead of double-tracked. The excavation for the double hight slope is no greater than for the double width, and it is an easier matter to excavate the one than the other, for the same reason a man can work faster and to better advantage with plenty of head room than he can stooping or lying down. In the trestles there is less width to support and a consequent saving in supporting material. The tipples are smaller because it is not necessary to support additional tracks, kickbacks, switches, etc., in addition to the dump. Just sufficient structure is needed to properly support the dumps. There is no storage room required with the self-dumping car haul, thereby cutting out a lot of trestle expense in addition to the saving made in the small tipple. However, possibly the most attractive and valuable feature associated with this new system outside of the safety, absolute control and material saving features, is the saving in labor expense.

Capacity

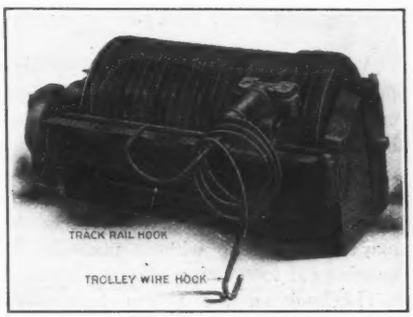
At the plant of the Wheeling Valley Coal Company the weighman operates the haul, and a boy at the bottom takes care of the feeder and uncouples the loaded trip. These two can do all the handling and dumping for an output of considerably over 2000 tons per day of eight hours.

This self-dumping car haul or conveyer car haul, as you like, is superior to a bucket conveyer for handling the output of a mine working in connection with the mine cars, for it takes the original package, the loaded mine car, and dumps the contents directly into the tipple, thereby saving a lot of additional handling with its consequent breakage.

The plant of the Wheeling Valley Coal Company is located at Lafferty, Belmont county, Ohio, on the Cleveland, Lorain and Wheeling division of the Baltimore & Ohio Railroad. The self-dumping car haul installed at this plant was erected by the C. O. Bartlett & Snow Company, Cleveland, Ohio, in accordance with plans and specifications furnished by F. C. Greene, of Cleveland, Ohio. All parts are fully protected by patents issued or pending.

A New Style of Automatic Gathering Reel

Any electric mine locomotive which is designed to depart from the regular trolley wiring on the entry, as in face gathering in rooms, must be equipped with an auxiliary conductor, which takes the



THE GOODMAN AUTOMATIC GATHERING REEL

form usually of a cable carried on a reel at the forward end of the locomotive. Wherever the trolley wire is hung, the locomotive derives its power current in the usual way. On leaving the overhead wire the trolley pole is pulled down and the cable from the reel is used as a feeder for the motor.

Room tracks being of wood, or frequently of unbonded steel, cannot always be depended upon for current return. So the cable is usually made duplex, one terminal for attachment to the trolley wire and the other to the bonded track on the entry. Through the core of the reel drum suitable electrical connections to the controller and motor are provided.

It is a matter of prime importance that the cable be always under positive control, paying out freely as the locomotive works away from the entry and winding on to the reel properly as the locomotive returns. To prevent fouling and cutting under the wheels, the cable must be kept constantly taut, whatever be the movements of the locomotive. This cannot be accomplished if the reel is operated as a part of the locomotive mechanism, as by driving from one axle, for instance, because in such a case the reel is inopera-

tive unless the locomotive wheels revolve; hence skidding of the wheels due to brakes or grade may throw the reel drive out of action at a critical moment and allow the cable to foul or be cut under the track wheels. Such a drive must also involve the unmechanical feature of a slipping clutch device to provide the speed changes required as the diameter of the cable coil varies.

ADVANTAGES OF INDEPENDENT OPERATION

These and other important disadvantages of axle driving for cable reels, together with numerous distinct advantages to be derived from independent operation, have dictated the design of the Goodman reel as a self-contained device, completely automatic in all its functions. Inside the drum of the reel are nested several heavy steel springs, connected up in series to operate much after the fashion of the familiar window shade roller. When the cable is drawn off as the locomotive advances, the springs are wound up; when the locomotive returns, the cable is kept taut, no matter whether the locomotive is running forward or backward or is standing still.

Action of the reel being entirely independent of the locomotive driving mechanism, the cable cannot be fouled or cut by being run over. Slipping or skidding of the wheels, with the locomotive moving in either direction, cannot affect the action of the cable reel. The cable also may be wound up without necessity for running the locomotive.

The hook on the return terminal is made of substantial form, to take hold of the rack rail and resist readily the cable tension in unreeling. The live terminal hook simply hangs on the trolley wire, which therefore takes none of the mechanical pull of the cable. In reeling, the cable is wound on in even layers by a spooling device driven by gearing from the drum of the reel.

DETACHABLE AND INTERCHANGEABLE

The Goodman reel being entirely self-contained, it is merely bolted into place on the locomotive, with simple electrical connections for delivery of power current to the motor. Hence in a mine where several gathering locomotives are operated, reels may be provided for only those locomotives which require them. In such a case the reels may easily be shifted from one locomotive to another as mining conditions dictate. Purchase of additional reels involves no changes in the locomotives themselves and, conversely, if temporarily a reel is not wanted it may be taken off and stored away for safe keeping until wanted again.

Not only, therefore, is the self-contained reel an example of utmost simplicity in itself, but also it provides perfect flexibility and the use of but few reels which latter are interchangeable among several locomotives.

Colliery Notes

H. P. Gillette is authority for the statement that handling dynamite sticks with the bare hands will give a headache to any one not used to it, because of the nitro-glycerin absorbed through the pores of the skin.

Recently compiled statistics show that 47.7 per cent. of the total number of mine accidents in Great Britain are attributed to falls of ground. In 1906 only five fatal accidents occurred from the use of electricity in the mines.

In the United States, prior to 1870, no provisions were made for effective ventilation in coal mines. The disaster at Avondale, Penn., in the fall of 1869 awakened the Legislature of that State to the importance of proper ventilation, and the other States in the Union followed the example of this commonwealth.

In using dynamite to break down coal, the charge should completely fill the hole, for even a small amount of air will greatly weaken the force of the explosion. If there is water in the hole, the paper of the cartridge should not be broken, but should be daubed with grease wherever water is likely to penetrate through the folds.

In rock blasting a cheap and effective protection against flying rock has been found to be afforded by a blasting mat made of 1-in. gas pipe and 1½-in. rope. The gas pipes form the sides of the mat and the rope is woven back and forth in this frame. This device has been found especially effective in mine blasting for a sump near a pump room.

Chemically there are coals of coking and non-coking classes which give the same composition, hence the difference must be in the form of combination. On exposure to the weather, most cokable coals entirely lose their coking properties; a similar condition results when such a coal is heated to 300 deg. C., and if subsequently submitted to the temperature of ignition, the yield would be only a pulverulent residue.

Experience has shown that two shots, at the most, are all that is absolutely safe to fire in a close chamber or heading. When three or more shots are fired, where the circulation of air is not strong, a considerable quantity of carbon monoxide results from the firing of the first shot and the sluggish air current does not have time to dissipate this gas before it is ignited by the flame of the following shots and an explosion is apt to follow if the chamber is dusty.

The principal causes of misfire when using an electric battery have been found to be: (1) overloading the battery, one of the most frequent causes; (2) broken fuse wire, caused by tamping; (3) broken circuit due to defective splicing of the connecting wires; (4) the common practice of taking a half hitch with the fuse wire around the primer, thus causing a short-circuit; (5) defective blasting cap, due to the cap's becoming unsoldered or to penetration of water.

Two estimates have been made by the Forest Service of the timber now standing in the United States, the maximum figures showing about 2,000,000,000,000 ft. board measure remaining. The present yearly consumption is nearly 100,000,000,000 ft., while the annual growth is only one-third of the consumption. If we take the annual growth at 40,000,000,000 ft. and calculate at the present rate of consumption, the probable duration of the timber supply is more than thirty-three years.

Tests made by the geological survey at St. Louis show that bony coal from West Virginia, containing 28.08 and 43.74 per cent. of ash, when tested in the gas producer, required for the former, 1.48 lb., and for the latter 1.95 lb. to develop one electric horse-power per hour at the switchboard. A further calculation showed that the efficiency of this bony coal equaled that of Illinois or Indiana coal used in the producer, and had from 2 to 2½ times the efficiency of Illinois or Indiana coal when used in the steam engine.

The importance of a more careful use of the by-products from coke ovens is beginning to receive more general recognition. One of the chief by-products of coke manufacture is sulphate of ammonia, which at present is the only practical means of supplying to the soil the nitrogen abstracted by the crops. The introduction of motor vehicles has opened an avenue of usefulness for the by-product recovery oven. It provides an outlet for benzol, as a motor fuel, and for tar as a means of combating the dust nuisance. The production of sulphate of ammonia from coke ovens has risen from 5403 tons in 1898, to 43,677 tons in 1906. The production of benzol from coke ovens in 1906 was 5,500,000 gallons.

It has been shown that mine air containing less than 9 per cent. gas may be made explosive by the heat radiated from safety lamps, if there is only a moderate current of air. The best chemical condition for a complete union of the elements of gas and oxygen in the air occurs when there is 9.33 per cent. of gas. If flame is brought in contact with such a mixture, a violent explosion will follow. The great danger of some safety lamps lies in the fact that, although the light of the lamp may become extinguished, the gas remains burning in the gauze above, and will communicate its flame to the surrounding air, if there is much current, or if the lamp is kept too long in the body of gas. An attempt to pull the lamp down too quickly in such a mixture naturally forces the flame through the gauze.

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The Position of Copper

About two months ago there was a feeling that January would see a sharp rise in the price of copper, because in that month the curtailment of production at the mines begun in October would become strongly manifest in the reduced output of the refineries. However, January has come and gone, there has been no marked advance in the market, and it is apparent now that the effect of any favorable conditions maturing in that month were anticipated and discounted in December. All of this throws a dim light upon the conditions. We cannot have a clear light until we have complete information as to the stocks on hand. There has been much idle talk in high quarters about creating stability in the market to the mutual advantage of producers and manufacturers. The idea has been to effect this by well-known "trust" methods, but we have seen them fail, have seen the leading producers fooled by the manufacturers, and the general feeling of uncertainty arise that exists at present. We shall have the desired stability when the industry as a whole learns that safety lies in the positive information as to conditions that monthly statistics of production and stocks on hand will give.

In the absence of such statistics it is possible to summarize the present situation only on the basis of the general trend of events. The extraordinarily large sales of copper for export last November were chiefly to consumers. Some were made, however, to speculators and are held now in European warehouses. In this country the manufacturers have continued to remain out of the market so far as large buying is concerned, because they have had no large requirements to cover. The industrial set-back, as manifest from such positive data as the reduction in pig-iron production, and in the earnings and orders of the Steel Corporation, and the increasing number of idle freight cars, is too severe to warrant any expectation of an immediate recovery, and the manufacturers of copper are going slowly because of lack of business. Such small quantities of raw material as they need are supplied by hand-to-mouth purchases and deliveries under monthly contracts.

It is self-evident that when their business revives the demand for copper will increase from them, and the price should consequently rise if the European demand continues unabated and if production remains stationary, but both of these are uncertain factors. Even at 13c. per lb. there is a fine profit in the production of a large amount of copper, and in those cases where the cost increased in 1907 because of higher wages and material conditions are returning to the normal. The statistics for 1907 did not show an immense falling off from 1906 (of course the price was high up to October) and the inference is rather strong that the stocks of refined metal in the United States at the end of the year were larger than was commonly supposed. This would explain the unresponsiveness of the market during January.

Money Lost in Mining

We reprinted in our last issue some portions of a recent letter in the New York *Evening Post* from its Pittsburg correspondent, not because it was of especial consequence, but merely because it illustrated aptly the point that we have repeatedly made, namely that the great losses of money in mining are suffered not through the occasional spectacular failures of big enterprises or by the deliberately fraudulent schemes which some of our Western friends are so anxious to exterminate by legislation, but rather by the drain of the money of the public into more or less honest, more or less misguided ventures that are not illegitimate but are entered into without competent engineering advice. What a familiar story it is to read of a company organized with a capital of several millions, shares boomed to triple the price of their flotation (which of course was many times too high in the first place), fond hopes of great speculative profits, expenditure of much money in a stamp mill, etc., failure of the mine to make the expected returns, excuses by the management, visits of the directors to look into matters, suspicions aroused, employment of engineers to examine and report (like physicians they are called in when the patient is sick, seldom being retained to keep him from becoming sick), and finally the knowledge that the property is "just a good prospect," which the original promoters sold for the price of a grandly developed mine.

Of course the great mining houses are not duped in this way, but the well-to-do merchants and professional men of a hundred of our cities are being taken in all

the time, and in the aggregate their losses outweigh many times those that are suffered by the butcher, the baker and the candlestick maker in Spanish Lost Bullion mines and the other amusing frauds of that nature, which is not to say that the disappearance of $500 may not be fully as poignant to the baker as $5000 to the wholesale merchant. But we have had altogether too much talk about the evils, and the remedies therefor, arising from the sharp practices of the cheerful rascals who deceive the small fry with their White Swans and other fakes too numerous to mention, and too little talk about the honest operators who palm off a prospect as a mine, even if it be an excellent and superior prospect. The desire to anticipate profits is preëminent in all minds and always will be. A few months ago in conversation with an estimable mining operator he described the new prospect he had been developing, the 200-ft. shaft and 400 or 500 ft. of drifts, and remarked that it was in shape to sell for $2,000,000 in New York, but the panic had made conditions unpropitious. He took a rosy view of his prospect, but he had no idea of mining its ore; his purpose was to develop something to sell. These are the gentlemen that our dabblers in mines need to be cautious with. Their safety lies in the employment of engineering advice, and the right kind of engineering advice.

A Bureau of Mines

The Senate committee on mines and mining has reported favorably the joint resolution, introduced by Senator Dick, increasing the scope of the Geological Survey, rather than the bill, also introduced by Senator Dick, for the creation of an independent bureau of mines. As a matter of fact the chief function of this joint resolution is to legalize what the Geological Survey has been heretofore doing under an erroneous construction of its organic law. This is really bad for the Geological Survey and does no material good to the mining industry. We have previously expressed the opinion that the interests of all concerned would be best served by confining the Geological Survey to its proper field of applied geology. As the matter now stands, the establishment of a bureau of mines will depend upon the action of the House. If the latter passes such a bill the Senate will probably agree to it. Apparently the project has not met with much interest in the Senate.

We confess our failure to see any great necessity for a Federal bureau of mines. The demand for it is based largely on grounds that such a bureau cannot act upon even if it be created, or would give it such opportunities for mischief that should cause the project to be discountenanced. As we have previously pointed out, it cannot properly engage in the paternalistic operation of free assay offices and ore-testing stations, or in making mine valuations. It cannot do anything effective in preventing mine accidents, which is an affair of the several States. It cannot do anything effective toward preventing the fraudulent promotions that bring discredit upon the mining industry. All of these things are hoped by many who are clamoring for such a bureau. The soundest of the demands is that the mining industry should be "recognized" at Washington. This is proper if the recognition does not lead to objectionable features that subsequently will be regretted.

We have previously pointed out various things that a bureau of mines may properly be expected to do. They are principally in the way of study and investigation. In this connection we recommend that any law provide for such work by commissions of outside experts retained temporarily for investigations in their specialties. This is more economical than the work of bureau officials and the results are more authoritative. It is the system employed by the Canadian mines branch, which has thus published a series of excellent reports upon subjects connected with Canadian industry. The purpose of these is to call attention to the mineral resources of the Dominion and show how they may be developed. Canada differs from the United States in that until recently its mineral industry has been rather backward and the Government aims to foster it through its department of mines.

On the other hand, the mineral industry of the United States is anything but backward, and rather than needing any official nursing, it has to fear Governmental meddling. The numerous complaints which come from the West about the administration of the mineral lands on the forest reserves are a sufficient foretaste of what a new bureau would do with too broad a scope. There are great questions affecting the public welfare to be studied, but the States directly concerned should not shirk their duty in such respects, and whether by State or by Federal government the studies should be made by leading experts (who are not attracted by bureaucratic positions). This is by no means to say that the Federal Government does not have many distinguished scientists and engineers in its various services, including the Geological Survey, but it is a well known complaint that private companies have won away some of its leading geologists, and probably no one dreams that a bureau of mining technology would draw from private practice any men of high attainments in engineering. All of which applies equally to technological work by the United States Geological Survey if the latter is to continue to engage in it at the sacrifice of its great opportunities in applied geology.

The American Chemical Society

The American Chemical Society has recently made some important announcements. It has decided to take steps to make itself of greater value to the industrial chemist, and with that in view is to organize a division of industrial chemists and chemical engineers. Also it is to undertake, beginning with January, 1909, the publication of the *Journal of Industrial and Engineering Chemistry,* which apparently will be similar in matter and method of preparation to the excellent journal published by the Society of Chemical Industry. The new publication will doubtless be valuable and will be welcomed by the chemical profession.

The society has also presented the report of the committee of the New York section appointed to consider measures to raise the standards of the profession, a question which has been an important subject of discussion during the last year. Various proposals were made. Among them was one that chemists should be examined and licensed by the States. This proposal is properly condemned. The other proposals were for the establishment of an institute of chemistry, similar to that of Great Britain and Ireland, whereby the fixing of the standards would remain completely in the hands of the profession (where it ought to be). The committee rejects this with three lame reasons and one that is sound from its own standpoint, viz., that it would involve the creation of a new chemical soci-

ety (which the American Chemical Society could hardly be expected to recommend). This brings the committee to the third alternative, which it recommends, viz., the establishment of a committee on the training of chemists, chief among its duties being the improvement of chemical training in the colleges. This, of course, is admirable in so far as it goes, but it fails utterly to meet the situation that requires attention in the opinion of the profession. The conclusion of the committee is practically to do nothing, wherefore it will fail to be satisfactory to many members of the society.

In the meanwhile a movement is on foot to create a society of chemical engineers which shall have high qualifications for membership and shall do in a narrow field what some members of the American Chemical Society have desired to do broadly. Professor Bogert, president of the American Chemical Society, is unfortunately taking an attitude unfriendly to the proposed organization. We think we are justified in thus interpreting Professor Bogert's position in view of his recent circular letter in which he clearly deprecates the formation of the new society and begs members of the American Chemical Society to consider the matter very carefully before voting to divide forces by the establishment of an institute of chemical engineers. This appeal is, moreover, a little unfair, inasmuch as the question is now awaiting a vote of the committee of one hundred having the matter in charge, a meeting having been held recently at which it was fully discussed with the conclusion to refer the decision to a mail ballot so that the absent members would be able to express their judgment.

Among this committee are many members of the American Chemical Society, including Professor Bogert, and its entire procedure has been conservative and deliberate. If it has erred at all, it has done so on the side of catholicity, aiming to include all views. If the consideration had been confined to those who are chemical engineers, strictly speaking, they would probably have gone ahead and formed their society before this. There seems to be a real need for such a society. However, that question is now awaiting the vote of the jury, the arguments having been made, and action on the part of the American Chemical Society, or its officials, at the present time appears to be somewhat improper.

The Question of Steel Prices

The steel makers in conference in New York last week under the leadership of Judge E. H. Gary, chairman of the United States Steel Corporation, refused to consider a reduction of prices. They explained that present quotations for steel products are not too high, considering the cost of production; and since they had not permitted prices to soar to unreasonable altitudes during the runaway market of a year or more ago, they did not see why they should now be expected to lower quotations in response to the commercial demands of the moment.

Although we do not uphold the principle of artificial regulation of prices, we are bound to admit that there is some justice in the present argument. The leaders in the steel industry did their best to apply the brake during the boom times of the last months of 1906, and the country no doubt owes them a debt of gratitude. But the market has nothing to do with either gratitude or justice. It is easy enough to demand less for one's goods than the market will give, but to keep the price above the level which the exigencies of supply and demand seem to warrant is another matter. Have the steel manufacturers the power to keep prices up as they undoubtedly did have the power to keep them down? Other powerful companies have learned the negative of this question. Can the steel companies succeed where others have failed?

Functions of the Consulting Engineer

The article on this subject by Mr. Rogers, which is published elsewhere in this issue, is one which investors in mines may take great profit from. Their attention may be especially directed to the advantage of retaining an engineer to lay out and supervise operations at mines which are not big enough to be supplied with the undivided services of a high-priced manager. There are several points in Mr. Rogers' article which are worthy of discussion, as to which we hope our readers will communicate their views. For the present we shall confine ourselves to his recommendation that the vendors of mines make more use of the services of the consulting engineer than they do. Mr. Rogers is quite right in his opinion that they would realize great advantage from such professional assistance. There are some engineers who announce that they accept commissions from prospective purchasers only. Every engineer has the right to say whom he will accept as a client and whom he will not. There is certainly no reason why an engineer should not act in behalf of a vendor and still be as honest and impartial as he would be for any other client. Nevertheless, it is to be recognized that the engineer accepting a commission from a vendor runs risks that he does not from other clients. These risks range from the possible misuse of his report to the failure to collect his fee. The average vendor who employs an engineer to report upon his property expects a favorable report which will assist him to sell the property; if he gets an unfavorable report, he is apt to refuse to pay the engineer. Our advice to engineers who accept commissions from vendors is to require full payment of the fee in advance.

Practical Problems

There are many problems of practical mining that await solution. If some of the schools that bemoan their great distance from mining districts, should devote themselves to directing their students toward the solution of some of the apparently small, but nevertheless important, problems in mining, they would soon cease bewailing their lot.

For example, if the school, which covets the possession of a stope wherein the student can learn to run an air drill, should take up the investigation of the angle beween the faces of the drill bit best adapted to drilling in granite, in limestone, in sandstone and other rocks, it would soon see its students gain respect for the important details that conduce so much to success.

While the subject of rock-drill efficiency is profusely discussed, this seemingly trivial, but really important, relation between the angle of the bit and the speed of drilling in different rocks, awaits investigation. So it is with many other details.

THE PRODUCTION of pig iron in the United States in 1907, as finally reported by the American Iron and Steel Association, was 25,781,361 long tons; an increase of 474,170 tons over 1906. Some details will be found on another page.

Metallics

Any company employing many foreign miners should have one shift boss on each shift who can speak their language.

With most air-lift pumps the best efficiency is attained when the submersion of the pump approximates 66 per cent. of the hight of lift.

The efficiency of a sinking pump is greatly increased by placing it close to the sump so that it can readily supply itself with water and so will not suck air.

In electrolytic refining of copper the electrolyte is always an acid solution of copper sulphate. Its usual strength approximates 0.5 part H_2SO_4 and 1.5 parts $CuSO_4$ to 100 parts of water.

At the new mill of the Utah Copper Company the coarse-crushed ore passes through a series of three Vezin samplers before going to the mill bins. The final sample amounts to 2½ lb. out of every ton that enters the samplers.

Each level of a mine should be equipped with air-tight doors; these should be placed, if possible, in an untimbered part of the crosscut or drift leading from the shaft station. These doors can be closed in case of fire, greatly decreasing the draft.

Formerly it was customary to sell paints at the gross weight of the package. Since the first of this year, most paint manufacturers have been packing paint in kegs, etc., marked with the net weight, and in the future most paint will be sold at net weight.

Leaky air pipes are costly. By allowing the air to escape they diminish the air pressure at the drill and so decrease the drilling efficiency. Thus not only as a source of waste in power are they costly but in other indirect ways they increase the expense of mining.

Iron sulphide has been suggested by C. A. Rose as a substitute for argol in the crucible assay of highly silicious ores which give trouble owing to violent ebullition. Another way of correcting this tendency to boil over is to start the fusion in a very hot muffle.

The collar of a shaft should be raised at least 4 ft. above the surrounding ground so that sudden rushes of water, like that from a cloud-burst, cannot run down the shaft. This raising of the collar makes a more convenient arrangement of trestles, etc., possible.

In shaft-sinking practice in West Australia it is common not to bolt the guard or protecting timbers to the bottom of the last shaft set but to let them hang from steel rope or chains a few inches below the set. This causes less of a strain to be thrown on the set when the protecting timber is hit by a flying rock.

Dynamite should not be stored in large quantities underground. At large mines only sufficient dynamite to last for two days should be kept on each level. This dynamite should be stored at a distance from the shaft and, if possible, in an unfrequented part of the mine so that, in case of explosion, the minimum damage will be done.

Crib timbering for shafts is more common at Kalgoorlie, West Australia, than framed sets. These crib sets are sometimes separate from each other by blocks, 2 to 3 in. thick; at other times the cribbing is placed so as to touch the cribbing above. Except, when in running ground, openings should be left between the different crib sets so that in bad ground the timbers can be eased.

By using a vertical type of hydraulic turbine it is possible, where the range between high-water and low-water hight approximates the length of draft tube effective at that altitude, to render a higher head available at the low-water stage of the river than if a horizontal turbine is used. When a horizontal turbine is used, as the floor of the power house must be above high-water mark, part of the draft or suction head must be lost.

Before beginning to sink a shaft through loose ground by piling, a bore hole should be put down to prove the depth of the wash which will have to be piled through. This is necessary, because in the ordinary system of piling, the size of the shaft gradually diminishes so that the length of piling required has to be ascertained before commencing the operations, in order that the initial dimensions of the shaft may be arrived at.

The drill-sharpening forges at the Komata Reefs mine, New Zealand, are heated by gasolene. In such forges the supply of gasolene can be regulated so that all danger of overheating the steel is removed. One 2¼-in. Cary burner is used for each furnace. The gasolene is used at 25-lb. pressure; the consumption is stated to be about 10 gal. per 8-hr. shift. About 2700 hand-drills are sharpened in two shifts by three men on each shift when using these forges.

In the electrolytic refining of copper, blister copper is used as an anode and an acid solution of copper sulphate as the electrolyte. The blister copper contains two classes of impurities, those soluble in the electrolyte and those insoluble in the electrolyte. Iron, nickel and zinc dissolve but do not precipitate. Antimony, tin and bismuth dissolve but are precipitated by the solution as basic salts. Arsenic is partly dissolved and partly goes into the mud. Gold and silver remain undissolved.

Hoisting engineers, when through hoisting, commonly "hang up" the skips or cages, level with the collar of the shaft so as to prevent anything from falling down the shaft. But, as this restricts the ventilating area of the shaft when air is most desired to drive powder smoke, etc., from the stopes, it is bad practice. The cage should always be hung several feet above the collar of the shaft so as to give the air a good chance to enter it. A guard rail should be sufficient protection at the mouth of the shaft, but gratings, traveling in guides and counterbalanced by weights, may be used, if desired.

Pipes used for underground pumping purposes should be sufficiently strong to resist all accidental stress as well as internal pressure. In calculating the required thickness of a cast-iron pipe under given conditions, it must be remembered that it is not possible to always keep the core perfectly central throughout; hence, a pipe may have an excess of metal on one side and a corresponding deficiency on the other side. Since the strength of the pipe is the strength of its weakest part, due allowance should be made for such defects. All pipes, before being installed, should be tested by hydraulic pressure up to three times the head they are calculated to withstand.

Men should never be allowed to ride through the shaft either on empty or loaded cars. Miners are very apt to forget to latch the car on the cage; even station tenders occasionally forget to do so, and then claim that some twist in the shaft timbers has thrown the car off the cage. In case a miner should be on the car when it catches upon the shaft timbers, he would be crushed between the car and the hood of the cage or the car and the timbers. A certain company in the West has used this fact as an excuse for not equipping the cages with hoods. Compelling the miners to ride on the empty decks obviates any such accidents and cancels any such "justification" for the omission of hoods on cages.

Plumbago compositions, such as are used for lubricating the chain gear on bicycles, are much better than white or red lead for rendering the joints of underground air pipes tight. The graphite protects the threads from rust, consequently the threading on the pipe does not deteriorate rapidly and the pipe can easily be taken apart when it is desired to move it to some other part of the mine. Air-pipe should be hung from hooks, driven into the timbers, when the drift is timbered, or into plugs, drilled in the sides or roof when in untimbered ground. When the air pipes are laid directly on the ground, they deteriorate rapidly owing to coming into contact with acid water; besides a fall of ground is then more apt to break the pipe than if it is suspended. The hooks should be placed close together so that the strain of the weight will not cause the joints to leak. When suspended any leaks are readily perceived. A frequent inspection of the pipe line by the mine superintendent and comments by him on its condition will greatly aid in promoting alacrity among miners in detecting leaks.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice or Suggested by Articles in the Journal, and Inquiries for Information

CORRESPONDENCE AND DISCUSSION

Negative Results in Pyritic Smelting

I am indebted to C. A. Grabill, who in the JOURNAL of Dec. 28 points out an error in a thermal equation which I took from "An Introduction to the Study of Metallurgy," by Prof. W. C. Roberts-Austen, fourth edition, revised and enlarged, London, 1898, pp. 348. It makes the reaction, $FeS + 3\ Fe_2O_3 = 7\ FeO + SO_2$ oxothermic involving + 85.2 cal. It should, as Mr. Grabill has very properly pointed out, be endothermic and equivalent to — 86.2 cal.

The conclusions to be drawn from this correction are, however, not at all as he states. On the contrary, a closer examination will convince him that for the case assumed, and which is the basis of this discussion, the best quantities involved by the change from the roasted ore, assumed by me for want of other information, to the crude-ore charge described by Mr. Beardsley in the JOURNAL of Aug. 24, do not show a gain of 26.40 cal. for the crude-ore charge, but involve a loss of 55.1 cal. Moreover, instead of the best value of the additional sulphide in the case of the crude-ore charge not accounting for one-half of the 63.75 cal. taken off in the shape of coke, as I had stated, it accounts for only one-seventh of that quantity. This is because in making the most favorable argument I could think of for the crude-ore charge I went much farther than is necessary for an instructive discussion of the case, and this will be apparent from what follows.

But before proceeding further I must offer my sincere apology for not having looked more carefully through the copy sent to me. I was exceedingly occupied at the time and did not examine my notes after they had been copied, and I am sorry to say that several errors have crept into my letter in the JOURNAL of Nov. 2, but their correction is only more adverse to the crude-ore charge than the previous estimates. When invited to make some observations on Mr. Beardsley's letter (the JOURNAL, Aug. 24), though I considered that many important details necessary for a consideration of the case were absent, I knew from practical experience certain fuel values of iron sulphides, but did not want to cite these while data from much higher authority were available. Also I was anxious not to err on the side of being unfavorable to the crude-ore charge which would not run in the furnace; and, being hurried with other matters, I wanted to take a short cut.

NEW CONDITIONS

In dealing with the subject in detail an interesting point not taken into account by Mr. Grabill will be developed. It will first be necessary to allocate the principal constituents of the roasted-ore charge that I had assumed. The composition of 100 lb. of the charge containing 90 lb. crude-ore equivalent (the flux and the difference between the weight of the crude and the roasted ore bringing up the charge to 100 lb.) is shown in the accompanying table.

COMPOSITION OF 100 LB. ROASTED ORE CHARGE

	Total.	Copper.	Nickel.	Iron.	Sulphur.	Oxygen and Difference.
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Matte, 34 per cent...	18.4	1.39	4.86	7.36	4.29	0.50
Copper and nickel..		0.20	0.20			
Sulphur in slag.....					0.61	
Iron as protoxide combined in ore..				5.85		
Iron as tri-oxide in roasted ore.....				9.32		
Iron and sulphur oxidized by ferric oxide.....				1.55	0.88	
Iron and sulphur oxidized by oxygen				16.13	9.22	
		1.59	5.06	40.21	15.00	

The table shows that the sulphur in the assumed charge was much more than could have been burned up in the combination, $FeS + 3\ Fe_2O_3$. This will be apparent the moment it is suggested. In assuming, as I did for the purpose of stating the most favorable case for the crude-ore charge, that the whole of the sulphur in the iron sulphide of the roasted-ore charge was oxidized by the solid oxygen in the ferric oxide, I was really conceding too much.

CORRECTED HEAT VALUE

We are now able to get a more correct heat value for the available sulphide in the roasted-ore charge. The best development from the available sulphur in the 100-lb. roasted-ore charge and the 9½-lb. coke would be: Sulphur, 9.22 lb., with oxygen, 32.73 cal.; 0.88 lb. sulphur with ferric oxide, — 2.37 cal.; coke, 9½ lb. at 6.71 cal., 63.75 cal.; total, 94.11 cal.

The crude-ore charge contained 19.25 lb. sulphur and the result of smelting was a low-grade matte, stated as 12 to 15 per cent. I have assumed a 15-per cent. matte; the case would be more unfavorable for the crude-ore charge when the matte ran 12 per cent. Of the sulphur 7.7 lb. is wanted for the matte and 0.56 lb. for the slag, leaving 10.99 lb. for the reaction, $FeS + 3\ O = 113.6$. This is equal to 39.01 cal. It will be interesting to notice how the furnace loses heat when low-grade matte is made.

The result stated in the manner employed by Mr. Grabill will be shown in the accompanying table.

HEAT INVOLVED IN CHANGE FROM ROASTED ORE TO CRUDE ORE, 100-LB. CHARGE.

	Roasted.	Crude.
Coke, 9½ lb. at 6.71 cal.....	63.75 cal.	
Sulphur, 9.22 lb. at 3.55 cal...	32.73	
Sulphur, 0.88 lb. at —2.69 cal.	—2.37	
Sulphur, 10.99 lb. at 3.55 cal...		39.01 cal.
Balance in favor of roasted ore charge.....		55.10
	94.11 cal.	94.11 cal

Of course, with ore roasted sweeter than in the case assumed, there will be more of the $FeS + 3\ Fe_2O_3$ reaction and correspondingly less of the other. The extreme would be reached when 23.14 lb. of iron was present as Fe_2O_3 and 3.86 lb. as FeS. This implies 7.9 lb. sulphur in the roasted ore per 100 lb. of crude-ore equivalent, as shown in the following calculation: Sulphur for matte, 4.29 lb.; sulphur for slag, 0.61; for combination with ferric oxide, 2.20; total, 7.10 lb.

On reviewing my heat balance sheet of the crude-ore charge described by Mr. Beardsley, I find nothing to change that would affect the net result.

My allowance for heat of combination of the FeO and the SiO_2 I will adjust to the numbers given in Prof. J. W. Richards "Metallurgical Calculations," for (Fe, Si, O_3) and (Ca_2, Si, O_4) and for (Fe, O) (Si, O_2) and (Ca, O). Biedermann's "Chemiker Kalender" 1905, p. 201, gives: SiO_2 (quartz) + CaO, + 33 cal.; FeO + SiO_2, + 9.3 cal. Professor Richards gives Ca_2, Si, O_4 + 471.3, from which we deduce 2 CaO + SiO_2, + 28.3 cal.

The heat production per 100 lb. crude ore charge is as follows: 6 lb. coke at 8.08 cal., 40.24 cal.; 15.7 lb. sulphur at 3.55 cal., 39.01 cal.; combination of 17.29 lb. iron with silica at 0.16 cal. per lb. of iron, 2.77 cal.; combination of 2.8 lb. lime with silica at 0.35 cal. per lb. lime, 0.98; total, 83 cal.

EXPENDITURE OF HEAT

For the heat expenditure per 100 lb. of crude-ore charge I will take for the heat in the escaping gases, and the slag and matte the same quantity as before. Mr. Grabill seems to prefer a lower quantity for the slag and matte and his opinion is every bit as valuable as mine on this

point, but I am influenced by Vogt's figures, who gives the melting point of $Fe_2 Si O_4$ as 1040 deg. C. and Professor Hofman (*Trans.*, A. I. M. E., Vol. XXIX, p. 704) has sufficiently confirmed this when he found the formation temperature to be 1110 deg. C. These results do not vary materially, considering the difficulties of high temperature determinations and the influence of small amounts of impurities in the material employed. I may also mention that in iron practice the total heat of slag is usually taken as 0.5 cal. and that Ackerman's results for the heat of "just melted" lime-alumina slags are from 0.347 to 0.4 cal. The heat in the slag of a working furnace must be much higher than that of the "just melted" slag.

For the cooling water I take the result of my own determinations on water-jacket furnaces which give 13.2 cal. and not 10 cal. as used in my former discussion.

For the heat lost by radiation I am inclined to think I was too high; I will now estimate it as 6 cal. The loss of heat by radiation and air connections from the hot jackets with hot water on the other side is to some extent calculable, but I cannot go into that now. There is also the loss of heat from the bottom of the furnace and that conducted away by pipes, columns, etc.

The decomposition of the water in the blast I will leave as it was. It is usual to do this in heat balances of this kind which generally do not account for the heat income. Moreover, it is not a case of the simple heating of the blast, but the heating of air in the presence of carbon, iron and other disturbing substances.

The following, therefore, seems to me to be a fair statement:

HEAT EXPENDITURE FOR THE CRUDE ORE CHARGE.

Escaping gas	14.7 cal.
Slag, 60.87 lb., at 0.46 cal.	28.0
Matte, 32.2 lb., at 0.33 cal.	10.63
Cooling water	13.20
Evaporation of moisture, 3.5 lb., at 0.6 cal.	2.10
Decomposition of limestone, 7 lb., at 0.45 cal.	3.16
Decomposition of water in blast	7.30
Radiation	6.00
Total	85.09 cal.

It will be well to point out that the loss of heat in cooling water and by radiation must increase nearly proportionally with a decreasing rate of running. Now, the furnace in question reduced its rate of running until it stopped. Supposing that it stopped at half the above rate; then the heat expenditure would have been 9.6 cal. more.

I do not take a pessimistic view of the thermochemical data we already have, and I believe that when properly used this information is a most valuable tool. We must not refuse to build because our tools look a little rough. Columbus would not have discovered America had he waited till he could build a "Lusitania."

LEWIS T. WRIGHT.

San Francisco, Cal., Jan. 10, 1908.

The Copper Belt of California

The JOURNAL of Nov. 30 contains an article by Herbert Lang on the subject "The Copper Belt of California," and inasmuch as I have been considerably interested in, and identified with the metallurgical development of at least three of the properties mentioned in this article, I wish to correct several statements which were evidently made on a basis of incomplete information from those properties.

The article credits the Penn Chemical Works at Campo Seco with having two blast furnaces. This is erroneous; there is only one blast furnace with two oil-burning reverberatory furnaces. Mr. Lang's reference to the manifest waste of labor at this plant must also have been based upon earlier operations, for later developments of the plant have shown an unusual number of labor-saving devices and very little manual labor around the plant.

I also find a reference to the Copperopolis plant, in effect that the plant is quiescent and for reasons supposedly connected with some difficulty of ore reduction; the statement is also made that blast-furnace practice would have proved more advantageous. At the time Mr. Lang's article was written, the Copperopolis furnace was in operation completing a good campaign. The original plan at Copperopolis was to handle the larger bulk of the ore by means of a concentrator, and these concentrates were to be roasted in mechanical roasters and smelted in a reverberatory furnace. For some reason unknown to me the concentrator was not completed and the furnace was supplied with heap-roasted mine ore in bulk containing a large proportion of alumina. Since coarse ore should be smelted in a blast furnace, the presence of a reverberatory furnace looks superfluous. From the standpoint of the plan outlined, the comparatively small expected tonnage of coarse ore would, however, not have warranted the installation of a blast furnace.

Under the heading "Blast Furnaces and Reverberatories," Mr. Lang seems inclined to favor the blast furnace and to discredit the reverberatory furnace. I believe that each furnace has its own particular field, and for that reason I think Mr. Lang will agree that most metallurgists are inclined to the combination plant as being the most useful in ore reduction. Since Mr. Lang has seen fit to speak very nicely of the metallurgical work at Campo Seco, (which is a combination plant) I do not think it would be out of place to recount the reasons why the plant was so constructed.

A COMBINATION PLANT

The Campo Seco blast-furnace practice is semi-pyritic with concentration of matte, as noted in Mr. Lang's article. After a run of two years on this basis, I advised the installation of an oil reverberatory furnace on the theory of reduced smelting cost and better saving of metal in the fines. The results of this installation were so noticeable a saving in cost and in ore value, that it was further advised that another reverberatory furnace be installed and that the blast furnace be used only for coarse ore. This second installation is now in operation, and I am at liberty to state that the reverberatory department of the plant is now smelting the same grade of ore 40 per cent. more cheaply than the blast furnace. Mr. Lang's statement that the richer slags from the reverberatory are unfavorable to that process from a standpoint of costs is quite correct; but when we reflect that this difference is less than 30c. per ton and when we weigh this difference against the loss of metal due to excessive losses of fine matte dust during the rehandling of mattes for blast-furnace concentration, we find an actual credit in favor of the reverberatory.

This result of blast vs. reverberatory practice under California conditions, was discovered before the Copperopolis reverberatory was advised. Had the latter furnace been supplied with the concentrates as planned, the results would have been the same as those later obtained at Campo Seco with the addition of the second reverberatory furnace, 17x50 ft., an exact counterpart of the Copperopolis furnace. This furnace is now smelting 120 tons of roasted fines per 24 hours with a saving of 40 per cent. in cost as compared with blast-furnace practice.

EDW. J. FOWLER.

San Francisco, Cal., Jan. 10, 1908.

Coal-dust Firing for Reverberatory Furnaces

I have read with interest the remarks in relation to coal-dust firing for reverberatory smelting furnaces in the JOURNAL of Jan. 11. In 1876-7 this system was adopted in the old Swansea works in Denver, Colo. At that time I spent considerable time at those works, and had ample opportunity to observe their operation. It was my opinion then, and is now, that it is an efficient and economical system of operating that type of furnace.

The Swansea works were under the management of Leopold Balbach. They operated entirely with reverberatory furnaces, and, of course, the furnaces were small; the entire plant was cheaply constructed, yet the furnaces operated, and, I think, profitably for a time. The type of works was, however, not suitable for the ores to be smelted in that section at that period. The coal-dust burning especially appealed to me as being a pronounced success. The apparatus for pulverizing the coal included buhr mill stones which took considerable power and required frequent dressing, and the method of handling was crude and unsatisfactory;

yet in spite of all disadvantages the management clung persistently to this method of firing as long as the works remained in operation. The impression always remained with me that it had superior advantages as a method of firing for matte furnaces, and that it was superior to gas, and direct coal firing, and when suitable coals can be obtained, that is my fixed opinion today. When the Boston & Montana works were erected at Great Falls, Mont., I tried to induce the late C. O. Parsons to look into this method before adopting gas.

As stated in the JOURNAL, the present system of producing and handling coal dust is highly developed, and it can be applied with comparative ease to any matte furnace. The system alluded to as being used by the Swansea works was developed and introduced by a Mr. West, a well known metallurgist of that time, and I believe he claimed some patents on the system.

L. C. TRENT.

San Francisco, Cal., Jan. 18, 1908.

The Virginia Geological Survey

I read with great surprise the editorial entitled "The Virginia Geological Survey" in the JOURNAL of Jan. 25. I am not informed, of course, as to the source of information on which the editorial was based, nor is it my purpose to seek the source, but I may be permitted to say that the full facts in the case were apparently not before the JOURNAL, and however good the motive, the editorial is, in my opinion, unjust.

Virginia has never had but one Geological Survey authorized by the General Assembly, namely, the Roger's Survey, from 1835-1842. That Virginia should establish and maintain a State Geological Survey cannot be questioned. The question then is at what point or place in the State should a State bureau be located to conserve fully the best interests of the entire State, and not which college in Virginia has a right to such a bureau. A State geological survey is a State bureau, and as such is not an organic part of any college.

The bill before the General Assembly of Virginia at present, asking for the establishing of a State geological survey, does not remove from any college in Virginia a survey, nor does it take from any college a department or chair of geology. Neither does it propose to establish a department or chair of geology at any college, but the creation of a State geological survey could only result beneficially to every college in Virginia which maintains a department of geology.

THOMAS L. WATSON.

Charlottesville, Va., Jan. 30, 1908.

The facts upon which our editorial was based were (1) an account of the organization of the recent geological survey of Virginia in the Introduction to Professor Watson's report on the "Lead and Zinc Deposits of Virginia," which was bulletin No. 1, and bore the imprint "Geological Survey of Virginia." (2) A previous private communication from Professor Watson stating that this survey had been suspended because of failure of the legislature to appropriate funds for it. And (3) an open letter from Prof. P. B. Barringer, president of the Virginia Polytechnic Institute, protesting against the transfer of the survey to Charlottesville. The last shows clearly that the present proposal is regarded as a transfer, whether it be the creation of a new survey or the revival of an old one, and the pamphlet enclosed by Professor Watson with his present letter recognizes that this feeling exists, and attempts to show that it ought not to. Our editorial did not enter into the question of the best interests of the State, which might best be served by the location of the survey at Richmond, and was confined to the manifest injustice to one institution by taking away this organization and giving it to another. The situation may be awkward, the discussion that has arisen over it is certainly unfortunate, but we have no reason to retract the opinion expressed in our issue of Jan. 25.

The Siemens Unit

What is the meaning of the abbreviation "S. E." occasionally employed by German technical publications, for example "58 S. E."? A. S. L.

Houghton, Mich.

Jan. 10, 1908.

The abbreviation "S. E." stands for "Siemens einheit," i.e. Siemen's unit, in measuring conductivity. This is equivalent to a column of mercury one meter long and one square millimeter in cross section at 0 deg. centigrade. The Siemens unit multiplied by 1.063 is equivalent to one ohm.

Calcination of Magnesite

In "The Mineral Industry," Vol. XV, on page 559 occurs the following sentence respecting the calcination of magnesite at the works of the Western Carbonic Acid Gas Company: "In this process the weight of gas obtained is about 5 per cent. of the weight of the magnesite used." As this seems a very small percentage, considering that the analysis of magnesite shows about 50 per cent. of carbon dioxide, I shall be very much obliged if you will inform me whether by chance the figured mentioned is a clerical error.

JOHN A. DENNISON.

London, Dec. 20, 1907.

The statement in question was taken from an article by Frank L. Hess, in *Engineering Magazine* for August, 1906, and reference to the latter shows that there was no clerical error in "The Mineral Industry," but apparently there was clerical error in the original.

The Western Carbonic Gas Company, of Emeryville, Cal., informs us that it uses in the kiln 90 per cent. of magnesite and 10 per cent. of coke, and obtains in the cylinder 50 per cent. of the weight of the magnesite used. There is a loss of 5 to 10 per cent. from the absorption tower. Just what proportion of gas comes from the magnesite and what comes from the coke, there is no means of determining.

Definition of Assays

What is the difference between a "control assay" and an "umpire assay?"

G. S. D.

Mexico, D. F., Mexico, Jan. 14, 1908.

A "control assay" is an assay made upon a sample of ore taken to determine its value in buying and selling. The sample is divided into four portions, the buyer taking one, the seller taking one, and two being reserved under seal for reference in the event that the buyer and seller are unable to come to a direct agreement. If the assays of the buyer and seller are reasonably close together it is customary to "split the difference" and settle for the ore on that basis. If, however, the assayers of the buyer and seller are unable to approach closely after a re-assay, one of the reserved samples is turned over to an independent assayer, who makes an "umpire assay" which is accepted by the buyer and seller as the basis of settlement, usually, however, with the provision that the result of the "umpire assay" must fall between the results of the "control assay" of the buyer and the seller.

British Coal Exports

The fuel exports from Great Britain for the full year, with coal supplied to steamships in foreign trade, were as follows, in long tons:

	1906.	1907.	Changes.
Coal	55,599,771	63,600,947	I. 8,001;176
Coke	815,224	981,418	I. 166,194
Briquets	1,377,209	1,480,893	I. 103,684
Total exports	57,792,204	66,063,258	I. 8,271,054
Steamer coal	18,590,213	18,618,823	I. 28,610
Total	76,382,417	84,682,081	I. 8,299,664

Approximately one-third of the coal product in the United Kingdom last year was consumed beyoud its borders.

The exports to the United States in 1907 were: To Atlantic ports, 15,533; Pacific ports, 31,682; total, 47,215 tons, or 10,964 tons less than in 1906. The larger exports to other countries in 1907 were: To France, 10,694,136 tons; Germany, 10,107,877; Italy, 8,317,637; Sweden, 3,700,322; Holland, 3,791,597; Egypt, 2,929,422; Russia, 2,863,669; Denmark, 2,814,509; Spain, 2,544,466; Argentina, 2,192,198 tons.

New Publications

ANNAES DE ESCOLA DE MINAS DE OURO PRETO. Pp. 236; illustrated. 6½x9½ in.; paper. Ouro Preto, 1907: Typographia Madeiro.

This volume contains a brief account of the thirtieth anniversary of the School of Mines at Ouro Preto, Brazil, followed by several papers on the geology, mineral deposits and mines of Brazil. Appended is a bibliography of works on Brazilian geology; also a number of analyses of minerals found in the country.

MINING TABLES. By F. H. Hatch and E. J. Vallentine. Pp. 200. 5½x9 in.; cloth, $1.90. New York and London, 1907: The MacMillan Company.

Contents: Weights and measures. Data relating to force and energy. Data relating to water. Data relating to air and steam. Data specially relating to mining. Data relating to surveying.

This book contains many tables that are to be found in the standard pocket-books. It contains also many of direct interest to mining men which are not readily to be found elsewhere. It will be a useful book of reference.

DIE EISENHUETTENCHEMIE. By Max Orthey. Pp. 258; illustrated. 5½x8⅓ in.; paper, 8 marks. Halle a. S., 1907; Wilhelm Knapp.

This is a summary of the methods used in the iron works laboratory, with special reference to the changes made in recent years. It treats, in successive chapters, of qualitative tests; of quantitative assays of ores, fuels, iron and steel and slags. It also describes methods used in analysis of gases, and in testing refractory materials of various kinds. In most cases descriptions are given of several methods in use, with some comments on the variations.

INTRODUCTION TO THE STUDY OF ELECTRICAL ENGINEERING. By Henry H. Norris. Pp. 404, illustrated. 6x9 in.; cloth, $2.50. New York, 1907: John Wiley and Sons. London: Chapman & Hall, Ltd.

Contents: Historical development of electrical engineering. Fundamental electrical and magnetic quantities. Materials of electrical engineering. Electric circuits. Magnetic circuits. Construction of electric generators. Operation of electric generators. Transformers and their applications. Construction and operation of power stations. Electric motors and their applications. Electric lighting and heating. Electrical measurements. The transmission of intelligence.

GRAPHITE: ITS PROPERTIES, OCCURRENCE, REFINING AND USES. By Fritz Cirkel. Pp. 307; illustrated. 6½x9½ in.; paper. Ottawa, Canada, 1907: Department of Mines, Mines Branch.

Contents: History. Chemical and physical properties of graphite. Occurrence of graphite. Origin of graphite. Composition of graphite ores. Qualities of graphites for commercial purposes. Determination of the values of graphites. Statistics of production, exports, imports and prices. Dressing and refining of graphite. Uses of graphite.

This is another of the valuable monographs prepared under the direction of Dr. Eugene Haanel, who is at the head of the Canadian Department of Mines. The scope of the present work is amply indicated by the table of contents as given above. The treatment of the subject is thorough and satisfactory. The purpose of this monograph, like its predecessors, is to call attention to the mineral resources of Canada and supply information that will contribute to their development. As is well known, the work of the Mines Branch is already having an important influence in this direction. We have no doubt that the present report on graphite will lead to the better development of that industry in the Dominion. Also the report will be appreciated by all technologists as the best treatise on its subject up-to-date.

DIE UNTERSUCHUNG UND BEWERKUNG VON ERZLAGERSTAETTEN. By P. Krusch. Pp. 517; illustrated. 6½x10 in.; paper, 16 marks. Stuttgart, 1907: Ferdinand Enke.

This work is a useful text-book, containing material lacking in most of the books hitherto published, about the business side of mining, together with a resumé of the author's views on economic geology, ore dressing and the investigation and valuation of minng properties generally. The book includes all that a college professor would give to his classes on these subjects. In the first section of 112 pages the author devotes 58 pages to a resumé of existing knowledge of ore deposits, their character, method of formation, weathering and enrichment, classification, etc. This is followed by eight pages on prospecting ore deposits by geologic examination, boring, magnetic surveys and electrical ore-finders. This brief summary is perhaps sufficient for the general reader but is decidedly inadequate for the average student. Ore dressing is discussed and dismissed in 14 pages, including several outline drawings. The valuation of ore deposits is treated under seven headings and in 30 pages. Methods of sampling and the estimation of ore reserves with visible, probable and possible ore, are very briefly described. The notes on cubic feet per ton and metal content of ore are brief and apparently prepared for students' note-books. This is followed by a short discussion of equations for the calculation of the value of an ore deposit according to Continental methods which serves to illustrate the difference between the American and European practice. Tables showing the effect of varying metal prices upon the estimated profits of a mine are useful and might be scanned by American students with profit. The general remarks concerning the valuation of ores are well worth perusal and are illustrated by a copy of an ore contract for the purchase of Turkish chrome ores. Transportation as a factor and the effect of freight rates from mine to market, upon the question of whether a mine will or will not pay are both considered rather fully. The last two pages of the first section give a brief list of books, periodical and statistical publications concerning the investigation and valuation of ore deposits. "The Mineral Industry" is prominently mentioned, both here and throughout the book; but it may be noted here that the book is singularly and painfully lacking in references, being in fact mainly an exposition of Dr. Krusch's personal opinions. While this is valuable and proper enough in the general account, yet when descriptions are given of districts not seen by the author, and when statistics are presented, the reader is entitled to know the source of the information, and to determine for himself the value to be given to the authority. A useful table giving the relative value of money and each standard of volume, area and weight for the countries of the world concludes part one.

In the second section each metal is discussed in turn and the principal modes of occurrence briefly described with tables and diagrams showing production and export for the principal countries. Under copper the author has grouped the deposits and discussed them as magnetic segregations, contact deposits, veins, metasomatic occurrences and bedded deposits.

The last is the only one illustrated or discussed in detail; and the cuts are the usual stock figures common to most text-books. A special section is devoted to a discussion of the value of copper ores with varying prices of the metal, and the basis on which European firms purchase such ores.

The same general order of treatment is followed for each metal in turn and the graphic representations of production are convenient for reference and as aids to memory.

In the third and last part of the book, called the statistical part, very brief accounts are given of the principal mines of each country, giving a concise summary of the mineral wealth of each nation with such figures concerning depth and extent of development, amount of production, etc., as are obtainable from official records. It is strange that the Butte, Montana, copper and silver deposits are only very briefly noted and the Coro Coro deposits in Bolivia are not even mentioned.

As a whole the work is a valuable one. Its chief merit is the great prominence given to the business side of the "Investigation and Valuation of Ore Deposits."

WALTER HARVEY WEED.

The United States Steel Corporation

Since the United States Steel Corporation controls over 60 per cent. of the production of finished steel in this country, its reports are necessarily an index to the course of the trade. It is fortunate that those reports are generally full and fair statements of the company's business and condition. The full report for 1907 is not yet ready, but the preliminary statement gives the financial results of operations for the year in such form that it is possible to review them in some detail.

The business of the earlier part of the year was so great that the break which came in late October could not quite offset it, but left the total above even the record made in 1906, and far above the figures of any preceding year. The net earnings of the June quarter were the highest of any quarter in the history of the company, while those of the September quarter, as shown below, were but little less. In the December quarter, however, they dropped to a figure for which we must go back to 1904 and 1905 to find a parallel. How sharp the break was is shown by the monthly net amount, which was $17,052,211 in October, dropping in November to $10,457,253, and in December to $5,034,531, or considerably less than one-third of the October statement.

The following table shows the results for two years past, the net earnings being the amounts remaining after deducting all operating expenses and ordinary repairs:

Net earnings:	1906.	1907.	Changes.
First quarter..	$36,634,490	$39,122,492	I. $2,488,002
Second quarter	40,125,033	45,503,705	I. 5,378,672
Third quarter..	38,114,624	43,804,285	I. 5,689,661
Fourth quarter	41,744,964	32,553,995	D. 9,190,969
Year.....	$156,619,111	$160,984,477	I. $4,365,366
Interest.....	$29,559,914	$29,966,008	I. $406,094
Depreciation...	21,253,876	22,196,571	I. 942,695
Total charges	$50,813,790	$52,162,579	I. $1,348,789
Balance.....	$105,805,321	$108,821,898	I. $3,016,577
Dividends.....	$35,385,726	$35,385,728	I. $ 2
Special approp.	57,590,651	57,983,529	I. 392,878
Total.....	$92,976,377	$93,369,257	I. $ 392,880
Undivided.....	$12,828,944	$15,452,641	I. $2,623,678

The dividends were the same in both years—7 per cent. on preferred and 2 on common stock. The special appropriations, which were nearly the same in both years, were for additions to property and new construction; and these large appropriations for such purposes in prosperous years are undoubtedly wise, if the corporation intends to hold its position. It is impossible to stand still, and the company has chosen to pay for needed progress out of current earnings, rather than by any increase of its capital obligations. This seems the prudent policy, and it is the line to which the company has adhered for several years. The only exception was the purchase, late in 1907, of the Tennessee Coal, Iron and Railroad Company by the issue of new bonds. This course may be justified partly by the exigencies of the occasion and the necessity of prompt action; and partly by the fact that the purchased property is abundantly able to bear the additional fixed charges involved.

The tonnage of unfilled orders on the books, which was reported at 8,489,718 tons of all descriptions on Jan. 1, 1907, decreased during the first and second quarters, and by Oct. 1 had fallen to 6,425,008 tons; thus showing some premonition of what was coming among buyers. On Jan. 1, 1908, the total had fallen to 4,624,553 tons. Probably this does not express the actual decrease fully, since the quantity includes much material due on yearly contracts, and it is well known that specifications and calls for delivery on such contracts have been very slow for the past two months.

While the Steel Corporation is undoubtedly entering on a period of light business and comparatively small earnings, the duration of which is quite uncertain, it is in a strong position, and able to meet what is coming. The more important additions to its plant, such as the great steel works at Gary, are well advanced and can be, at least partially, put in operation for a moderate expenditure in addition to the appropriations already made. The total undivided surplus, or working capital, is large enough to provide for all contingencies likely to arise before the present depreciation gives way to a new prosperity; at least unless that change should be postponed much further than all experience leads us to expect.

American Institute of Mining Engineers

Notice is given that the 94th meeting of the institute for the reading and discussion of professional papers will be held in New York, beginning Feb. 18. The headquarters will be in the United Engineering building, No. 29 West Thirty-ninth street.

The annual business meeting of the corporation will be held at the office of the institute on Feb. 18, at 11 a.m., for the election of officers.

One session for the reading of papers, etc., will be held Tuesday evening, Feb. 18, and three on Wednesday. A reception will be held at the United Engineering building on Thursday evening. Visits to the Hudson river and East river tunnels and other points of interest have been arranged by the local committee. A number of papers have been presented for this meeting.

Shaft timbers should be kept as near the bottom as is consistent with economy. This not only decreases the danger of slabs falling from the walls, but it also, by bringing the turning point of the convection currents in the shaft nearer the bottom, improves the ventilation.

Pig-iron Production in 1907

Some interesting details, furnished by the American Iron and Steel Association, are given below.

The production by half-years for three years past was as follows, in long tons:

	1905.	1906.	1907.
First half.....	11,163,175	12,582,250	13,478,044
Second half.....	11,829,205	12,724,941	12,303,317
Total.....	22,992,380	25,307,191	25,781,161

The production in 1907, classified according to fuel used, was as follows:

	Tons.	Per Ct.
Bituminous coal and coke.....	23,972,410	93.0
Anthracite and coke mixed....	1,335,286	5.2
Anthracite coal.....	36,268	0.1
Charcoal.....	437,397	1.7
Total.....	25,781,361	100.0

Very little iron is made with raw bituminous coal, and it may be assumed that 99 per cent. of the first class of iron in the table was made with coke. Included in charcoal iron is a small quantity made by the electric furnace, in California.

The production by States was as follows, in long tons:

	1906.	1907.	Changes.
New England.....	20,239	19,119	D. 1,120
New York.....	1,552,659	1,659,752	I. 107,093
New Jersey.....	379,390	373,189	D. 6,201
Pennsylvania....	11,247,869	11,348.549	I. 100,680
Maryland.....	386,709	411,833	I. 25,124
Virginia.....	483,525	478,771	D. 4,754
N. C., Geo. & Tex.	92,599	55,825	D. 36,774
Alabama.....	1,674,848	1,686,674	I. 11,826
West Virginia....	304,534	291,066	D. 13,468
Kentucky.....	98,127	127,946	I. 29,819
Tennessee.....	426,874	393,106	D. 33,768
Ohio.....	5,327,133	5,250,687	D. 76,446
Illinois.....	2,156,866	2,457,768	I. 300,902
Mich. & Ind.....	369,456	436,507	I. 67,051
Wis. & Minn.....	373,323	322,083	D. 51,240
West of Miss.....	413,040	468,486	I. 55,446
Total.....	25,307,191	25,781,361	I. 474,170

The larger proportional increases were in Illinois and New York.

Blast Furnaces

The whole number of furnaces in blast on Dec. 31, 1907, was 167, against 359 on June 30, 1907, and 340 on Dec. 31, 1906. The number of furnaces in blast at the end of 1907 was smaller than at the close of any year since 1896, when but 159 furnaces were active. At the close of 1907 there were 276 idle furnaces, as compared with 89 idle furnaces at the close of 1906.

The number of furnaces actually in blast in the second half of 1907 was 388, as compared with 382 in the first half. In 1906 the number in blast during the last half of the year was 374, against 361 in the first half.

On Dec. 31, 1907, there were 30 furnaces in course of erection, 4 furnaces were being rebuilt, and 1 furnace was to be revived. Of the building furnaces 2 were in New York, 8 in Pennsylvania, 1 in Alabama, 7 in Ohio, 8 in Indiana, 2 in Illinois, 1 in Michigan, and 1 in Wisconsin. When completed 29 of these furnaces will use coke or mixed anthracite coal and coke for fuel and 1 will use charcoal.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

E. Loizeau, of New York, is in Mexico on professional business.

Douglas Waterman, mining engineer, has sailed for Peru, to take charge of a copper mine.

E. Bignall and W. D. Farragut, of Denver, are in Mexico, visiting various mining districts.

G. F. Crawford, of Kansas City, Mo., has been examining mining property in Clear Creek county, Colorado.

W. F. Blatchley, State geologist of Indiana, recently met with an accident in which his right leg was badly broken.

George Huston, of Mullan, Idaho, has taken charge of the Washington Consolidated Mine, near Galena, South Dakota.

O. N. Merihugh, manager of the Marshall tunnel, near Georgetown, Colo., has returned from a business trip to Eastern points.

N. B. Storer, president Mexican Union Mines, has returned to Chicago, after a trip to the company's mines in Jalisco, Mexico.

S. E. Bretherton, general manager of the Great Western Gold Company, Ingot, Cal., expects to visit New York on business during February.

E. H. Hamilton is acting in a consulting capacity at the Garfield plant of the American Smelting and Refining Company, at Garfield, Utah.

Dr. John Galbraith, principal of the Toronto School of Practical Science, has been elected president of the Canadian Society of Civil Engineers.

Frank De Votie, of Oaxaca, Mexico, has been visiting in Greeley, Colo., where he succeeded in raising money for the development of property in Mexico.

Gilman A. Hackett has just returned from Wyoming, and expects to leave New York early in February with oil-well drilling machinery for Buenos Aires.

Harry A. Lee, of Denver, Colo., has returned to New York from Cobalt, Ont., and left the city Feb. 1, to examine some mining properties in Utah and California.

Dr. William B. Phillips, of Birmingham, Ala., has gone to Oaxaca, Mexico, to examine some mining properties. He will return to Birmingham about Feb. 23.

B. C. Mackenzie is at Port Arthur, Ont., inspecting the Atikokan Iron Company's blast furnace and the iron mine at Atikokan for the Ontario Bureau of Mines.

Gerald M. Browne recently left London for eastern Siberia, to inspect the Kluchi gold mines, of which Pearse, Kingston & Browne, of London, are engineers.

Spencer W. Clawson and John L. Gillingham are partners in the firm of Clawson & Gillingham, mining engineers and assayers, with office at Los Angeles, California.

Cyrus Robinson, of New York, is at the properties of the Teziutlan Copper Company, Teziutlan, Puebla, Mexico, where he will be several months in the interests of the company.

Percival J. Smith, superintendent of the Ahmeek Copper Company, in the Lake Superior region, is going to Globe, Arizona, to examine the properties of the Sultana-Arizona Copper Company.

W. N. Roberts, Jr., has resigned his position as chief engineer of the Rock Island Coal Company, at Hartshorne, Oklahoma, in order to do some prospecting in the southern part of California.

William M. Laird, of Pittsburg, Penn., president of the Pittsburg Consolidated Mining Company, near Idaho Springs, Colo., has been inspecting the property of the company, accompanied by G. E. Morris, also of Pittsburg, and J. P. Mathieu, of Philadelphia.

F. W. Denton, manager of the Copper Range Consolidated Company, of Painesdale, Mich., recently met with a severe accident while riding in a sleigh. He was thrown from the sleigh against a barbed-wire fence and suffered very severe lacerations of the face.

Arthur A. Hammerschlag, director of the Carnegie Technical School, Pittsburg, has gone to Europe. He is commissioned to study the most approved methods of mining coal abroad, the machinery used and the courses of mining taught in foreign technical and manual schools.

Obituary

Otto Rader, a German mining engineer, was assassinated at Urique, Chihuahua, Mexico, by a young Mexican on Jan. 19.

William Gillies, who died in Chicago, Jan. 20, aged 69 years, was born in Scotland, but came to this country over 50 years ago. For 28 years he had been connected with some of the concerns later merged with the Illinois Steel Company, and since 1898 had been consulting engineer of that company.

Roscoe Peacock, who died at Berlin, N. J., Jan. 26, aged 27 years, was educated as a mining engineer, and had worked in western Pennsylvania. Recently he was engaged with the Chesapeake & Ohio Railway Company, making maps of a number of its coal mines in the New River region of West Virginia.

Arnold C. Saunders, of the firm of M. A. Hanna & Co., Cleveland, Ohio, from 1885 to 1893, and since the latter year at the head of A. C. Saunders & Co., a Cleveland coal firm, died Jan. 22, aged 55 years. He was president of the Lorain Coal and Dock Company and vice-president of the Johnson Coal and Mining Company. For some years his firm was engaged in the Lake Superior ore trade.

Francis T. Freeland died suddenly Jan. 28, at the Hotel Colonnade, Philadelphia. Mr. Freeland was born and brought up in Philadelphia, graduating from the University of Pennsylvania, in the course of mechanical engineering in 1879, after which he took a post-graduate course in mining engineering, which he completed in 1881. While at the university Mr. Freeland distinguished himself as a mathematician, discovering several new methods and being remembered at the university to this day for his exceptional proficiency in the science of mathematics. Soon after his graduation he went to Leadville, Colorado, where he entered the employment of the Iron Silver Mining Company as mining engineer, and in the course of a few years became the general superintendent of all the mines of the company. He carried on the development of these mines and conducted their operations with a high degree of skill, which won for him well deserved praise from the officers of his company and the high esteem of his fellow members in the profession. He joined the American Institute of Mining Engineers in 1885 and soon afterward contributed an important technical paper on the "Sulphide Deposits of South Iron Hill, Leadville." To subsequent volumes of the "Transactions" he contributed papers on fault rules and mining leases. The papers were of high technical character and displayed the keen analytical mind, breadth of view and distinguished professional attainments, which a wide circle of professional acquaintances had previously recognized in him. Early in the '90s, Mr. Freeland took charge of important mining properties at Aspen, Colo., and in 1894 he became the general manager of the Isabella mine at Cripple Creek. He remained in charge of the properties at Aspen and divided his time between Aspen and Cripple Creek. In each place his mines ranked among the most important of the respective camps, and he managed them with the same degree of skill—combining good engineering practice with an excellent commercial judgment—which had characterized his previous operations at Leadville. In 1902 he was with the Frisco Consolidated Mining Company at Gem, Idaho. In the later years of his life Mr. Freeland, having attained a fair fortune from the practice of his profession, retired from active work and devoted himself chiefly to traveling. Recently he returned from a trip around the world. Mr. Freeland never married. The many friends, whom he made first in Leadville and later in Aspen and Cripple Creek, will learn with sorrow of his untimely demise.

Societies and Technical Schools

Western University of Pennsylvania—In the new group of buildings at Schenley Park, near Pittsburg, the first building to be erected is that for the new school of mines. The sum of $175,000 has been appropriated for this building.

American Society of Mechanical Engineers—The first meeting of the Gas Power Section will be held Feb. 11, in the Engineering Societies building, New York. The subjects under discussion will be "Experimental Gas Turbines in France," "A Simple Continuous Gas Calorimeter," "A Gas Engine and Producer Guarantee." Other subjects relating to the question of gas power will also be discussed.

Machinery Club of New York—This club has completed its arrangements for rooms in the new Fulton Terminal building on Church street, New York, and will open on May 1 next. The membership lists are now being made up. F. H. Stillman is president, and the temporary office is at 26 Cortlandt street. The club has been organized for the purpose of providing a pleasant meeting place for entertainment in the heart of the business section of Manhattan, conveniently located to most of the offices of the concerns interested in the various branches of the machinery and metal trades.

School of Mines and Metallurgy of the Pennsylvania State College—The legislature of Pennsylvania at its latest session appropriated $50,000 for this school, of which sum $20,000 were for further extension of its buildings and $30,000 for its maintainance. The buildings, as planned and partly built and occupied, contain over 60,000 sq.ft. of floor space. The buildings contain laboratories and lecture rooms, for the instruction in crystallography, mineralogy, petrography, geology, mining geology, metallography, metallurgy, assaying, ore dressing, coal washing, mining, etc. Among the recent appointments are these: Clarence P. Linville, assistant professor of Metallurgy; Frank A. Dalburg, instructor in Mining and Metallurgy; Lloyd B. Smith, instructor in Mineralogy and Geology; Howard I. Smith, instructor in Mineralogy and Metallurgy. The summer school in surveying and mining was conducted at Canonsburg, Penn., in the mines of the Buffalo & Pittsburg Coal Company, under the direction of Messrs. Dalburg and Smith. Later a large party of students spent the remainder of the summer at the mines of the Nipissing Company, Cobalt, Ontario. The class graduating, in the school, in 1907, numbered 26 men.

The options now offered are (1) Mining Engineering; (2) Mining; (3) Engineering Geology; (4) Mining Geology; (6) Metallurgy and Assaying. It is proposed later to add to these options (7) Electro-Metallurgy (a distinct field from Electro-Chemistry or Electro-Chemical Engineering;) (8) Ceramic Engineering; (9) Cement Engineering, and (10) Ceramics, including Cement Work and Glass Making.

Industrial

The Lehigh Valley & New England Railroad is preparing to let a contract for 250 steel coal cars.

The Brier Hill Iron & Coal Company, Youngstown, Ohio, will blow out its blast furnace about March 1, when it will be torn down and rebuilt.

The Birmingham, Ala., rolling mills of the Republic Iron and Steel Company met with a little accident in the rolling department recently, curtailing the already short production.

The Massachusetts Fan Company, Watertown, Mass., has a "perpetual catalog," to which additions are made as needed. It contains much valuable matter relating to blowers, and to heating, ventilating, drying and mechanical draft apparatus, etc.

The Campbell Manufacturing Company has been organized at Gadsden, Ala., with $50,000 capital stock. The company will manufacture soil pipe and fittings. The various soil pipe plants in the Birmingham territory are doing nicely and are finding a growing trade for their product.

The second battery of 30 Semet-Solvay coke ovens in the Pennsylvania Steel Company's plant at North Lebanon, Penn., has been started up. Since November only 30 ovens have been in use, but now 60 are making coke. The third block of 30 ovens is still idle.

In Birmingham, Ala., Feb. 3, W. H. Hassinger, T. S. Kyle and J. M. Morris were elected trustees by creditors of the Southern Steel Company, the corporation recently adjudicated bankrupt. The trustees will make a joint bond for $100,000. The stockholders in New York are reorganizing the company and a resumption of operations of plants is assured within six weeks.

At the recent annual meeting of the New York & New Jersey branch of the National Metal Trades Association, Secretary Hunter gave out the following statement, summarizing reports concerning present conditions: "Reports on the conditions of business prevailing in the plants of the members, including shipyards and plants manufacturing engines, boilers and general machinery, showed that the business had fallen off more than 50 per cent. during the last year, the greatest decline being shown during the last three months, except in ship repairing. In normal times the members employ about 12,000 men, and about one-half that number are employed now. No reductions in wages were made, and in some cases wages were increased."

The Bureau of Statistics has issued a bulletin in advance of the completed figures for the calendar year 1907 comparing the value of manufactures of iron and steel exported from the United States in 1887, 1897 and 1907. The statement is made that for the last full year the total is approximately $200,000,000 against 63,000,000 in 1897 and $16,250,000 in 1887. The increase in the last decade was more than 200 per cent., while that for other merchandise exported was less than 100 per cent.; and while iron and steel manufactures formed 5.8 per cent. of our total exports in 1897, they constituted 10.8 per cent. in 1907. Nearly half the total last year consisted of machinery of various kinds.

Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

F. H. Lloyd & Company, Limited, Wednesbury, England. Steel Castings. Pp. 14, illustrated, paper, 5½x8½ in.; 1907.

The Electric Controller and Supply Company, Cleveland, Ohio. Lifting Magnets. Pp. 32, illustrated, paper, 8x10½ in.; 1907.

Mussens Limited, Montreal, Canada. Catalog No. 16. The Pulsometer Steam Pump. Pp. 28, illustrated, paper, 7x9½ inches.

United Engineering and Foundry Company, Pittsburg, Penn. Lever and Vertical Shears. Pp. 74, illustrated, paper, 8½x10½ in.; 1907.

Utah Mining Machinery and Supply Company, Salt Lake City, Utah. 24-inch Duplex Wrought Steel Callow Screen. Insert, 8¼x10½ in.; January 1, 1908.

The Lima Locomotive and Machine Company, Lima, Ohio. Catalog No. 15. Shay Geared and Rod Locomotives. Pp. 72, indexed, illustrated, paper, 6x9 in.

Construction News

Skidoo, Cal.—It is proposed to build a 10-stamp custom mill. J. H. Wilson, Skidoo, Inyo county, Cal., is managing the project.

Deadwood, Cal.—It is reported that a mill will be erected in the spring at the West Point mine. Mark Manley, Deadwood, Trinity county, Cal., is superintendent in charge.

Callahan, Cal.—The owners of the Adeline Ricks mine are considering the question of doubling the capacity of the mill, which has 10 stamps. Address at Callahan, Siskiyou county, California.

Central City, Colorado—The Hampton Consolidated Mining and Milling Company will install electric machinery, air compressor and drills at its property. Louis Larsen, Central City, Colo., is superintendent.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at Butte, Salt Lake City, San Francisco and Indianapolis

REVIEWS OF IMPORTANT EVENTS

San Francisco

Jan. 29—El Oro No. 2, which is the largest gold dredge in the Oroville, Butte county, field, commenced operations Jan. 22. On Jan. 23 Boston No. 2, one of the oldest dredges in the same district, sprung a leak and sank. It will probably be dismantled and the machinery placed on a new hull.

The Melones Mining Company, Frank Langford, superintendent, after a shutdown of eight months owing to the distruction of the power flume, started running again on the basis of 8½ hours actual work of the miners. A strike ensued among the miners, who were not satisfied with conditions, and Mr. Langford explains that the mine is really being worked "upside down." There are three entrances to the mine—through the main shaft at Carson hill, 400 ft. to the present stopes; through a 1500-ft. tunnel and up a shaft to the same stopes or through the mill tunnel 1100 ft. below Carson Hill, and one mile in length, to the shaft, and up the shaft to the same stopes. Instead of the miners going through the main shaft at Carson hill, 1½ miles from Melones, or ¼ mile from the town of Carson, they have been pulled in on the electric train through the long mill tunnel and hoisted up through the shaft to the stopes at an extra and unnecessary time and expense of half an hour per day, going and coming, because the mine is at Carson Hill and the miners live at Melones. The whole grievance of the miners has to do with this 15-minute ride at each end of the shifts. The mine is well ventilated and dry, but the ore is of low grade and will not pay except under certain conditions.

The committee of Oroville citizens appointed to canvas for funds to place a drill upon the diamond mine near that place and prospect the deposit of "blue" ground has met with success and plenty of funds are at disposal. As soon as a drill can be obtained the prospecting operations will commence. M. J. Cooney, who owns the ground, and has had experience in diamond mining, is firm in his belief of the existence of diamonds at this point. If found at Oroville, the Cherokee properties not far away will also be prospected by drill. Some few small diamonds have already been found at the latter place.

Numbers of unemployed miners have come to Grass Valley, Nevada county, of late, because it is the center of quartz mining in the State. They are disappointed because there is no work for them, all the large mines in that district having kept their men steadily employed during the financial crisis. The new men have mainly crowded in from the copper-mining districts and other places where the mines have closed down during the winter. Grass Valley is a pleasant place to live all the year round and the mines are not closed during winter, as in higher mountain localities. The men once employed there usually remain, as they get good wages and steady work for 12 months of the year.

The largest mining deal in Shasta county since that of the Mammoth mine is that of the sale of the Summit group of copper mines at Kennett to the Stauffer Chemical Company, of San Francisco for a consideration reported to be about $100,000. The group consists of 30 claims lying adjacent to the Mammoth properties. While the mines have been under bond and development about 25 miners have been employed, but under the new ownership it is expected that the force will be largely increased.

As the result of some differences between the officials of the California Gas and Electric corporation and the Steifer Mining Company, of Magalia, Butte county, the power was temporarily shut off from the mine and it began to fill with water, reaching a hight of 62 ft. on the incline, leaving the steam pumps under water. The mining company has a small auxiliary steam-power plant which saved it some trouble, and has now closed the mine entirely until a private power plant can be put on, having decided not to take electric power from the company formerly supplying it. The men formerly engaged in the mine are now at work completing the new electric plant.

The new steel smokestack of the Mammoth smelter at Kennett, Shasta county, has been put in use. It is 200 ft. high and 18 ft. in diameter at the top, built on a concrete base. Between the base of the smokestack and the furnaces the smoke is carried through a horizontal dust chamber 500 ft. long, 30 ft. wide and 15 ft. high. This is to enable the flue-dust to settle. The old smokestack when repaired will be used in connection with the new converters.

About 2500 tons of copper ore have been shipped to the American Smelting and Refining Company's plant at Garfield, Utah, from the Golinsky group of mines at Kennett, Shasta county. The Guggenheim interests are supposed to hold the bond on this group.

The Mountain Copper Company is exploring a large tract of mineral ground in the vicinity of its other properties in Shasta county by means of diamond drills. This company has always used these drills extensively in its prospecting work.

The old Zantgraf mine, owned by the Montauk Consolidated Mining Company, in El Dorado county, has been sold to P. C. Drescher, of Scranton, under order of court. It is expected that the mine will be in running shape within three months. The old Zantgraf was a large producer in its day and was sold finally to the Montauk Mining Company. This company was thrown into the hands of a receiver in 1901, through insolvency proceedings, but operations continued until 1903, when the mill was destroyed by fire.

It is understood that the Dutch mine in Tuolumne county, at one time a large producer, has virtually been sold by the trustee to Eastern men who will pay off all the debts and rehabilitate the property. The official sale was postponed, on request of the trustee, until March 8.

Chas. E. Hassner has been experimenting some months with the tailings from the Argonaut quartz mine at Jackson, Amador county, and now announces that the process used has been successful. The small experimental plant is to be enlarged.

Dredge mining is materially on the increase in Calaveras county, where one dredge has been operating for a year or two at Jenny Lind, on the Calaveras river. The Isabel Gold Dredging Company at the same place, is now putting up a dredge on the Cutler ranch, and will also dredge for gold near the Calaveras river. In the same county two new dredges are to be installed on the Holman and Hill ranches, near Camanche. These will be run by electric power like the others. A dredge is also being built at La Grange, Stanislaus county, where it will operate in the Tuolumne river. This is among the large machines of the State. In addition to this Boston men have bonded 600 acres of dredging land along the Tuolumne river, and are prospecting it. It results are at all favorable a dredge will be constructed and the ground mined by that method.

Salt Lake City

Jan. 31—The January dividends from Utah mines amounted to only $93,000, the smallest amount distributed among shareholders of Utah mines in many years. This is due partly to the closing of some of the copper smelters of the Salt Lake valley and partly to low metal prices.

The mines making the distributions and amounts were Colorado, $50,000; Mammoth, $40,000; Utah (Fish Springs), $3000.

The copper smelter of the United States Smelting, Refining and Mining Company, at Bingham Junction, has been shut down; this is the last of the three copper smelters closed on account of the "smoke" litigation. The value of the smelter property, not to include mines and other industries affected, now idle, probably amounts to $6,000,000 or $7,000,000.

The only copper plant left in operation where custom ores are treated is the Garfield smelter of the American Smelting and Refining Company, at Garfield, 15 miles west from Salt Lake City; it and the Yampa smelter in Bingham are the only smelters near Salt Lake City now treating copper ores. The American Smelting and Refining Company is operating its lead smelter at Murray under a modified decree of court, which was obtained though a compromise arrangement with a majority of the farmers who appeared as plaintiffs in the trial of the late smoke suits. The United States company is still working its lead smelter at Bingham Junction, but the management contemplates drawing the fires within the next 30 days unless some similar compromise can be arranged in the meantime. Probably in the end this smelter-smoke trouble with the Salt Lake valley farmers will work out to the good of all concerned. There is no doubt that the smoke from the several plants has done damage to vegetation; but the problem can be and probably will be solved by moving the smelters out to some point beyond the Garfield smelter or to some other place away from the agricultural sections. However until this trouble is settled, some of the smaller mines will suffer for the lack of proper facilities to handle their ore.

At Tintic the construction of the smelter of the Tintic Smelting Company is going ahead steadily and Jesse Knight, president of the company, is authority for the statement that it will be ready for commission during the latter part of April. All of the equipment, except the transformers, is on the ground. The grade for the railroad between the smelter and the principal mines of the Tintic district is completed and about one-half of the track is laid.

The Yankee Consolidated Mining Company has arranged to take over the properties of the Mountainview Mining Company, in the Tintic district; shareholders of the latter company are to receive 500,000 shares of Yankee stock, which is to be obtained by increasing the capital stock of the Yankee Consolidated company to 1,000,000 shares. The shareholders of the Yankee Consolidated, at the annual meeting, held recently, authorized this increase. The Mountainview company also turns $6000 in cash into the Yankee Consolidated Company's treasury, which contained at the time of the consummation of the deal about $26,000.

The mill building of the Ohio Copper Company, which is being erected near Bingham, is almost completed and equipment is being installed. This is one of the Heinze enterprises that has been held back on account of the financial reverses of Mr. Heinze. It is claimed, however, that the entanglements of the Ohio company have been straightened out. The Mascotte adit is being advanced; it is now 12,300 ft. long and is less than 500 ft. from the point where it will cut the main shaft of the Ohio mine.

An option on the copper smelter of the Utah Smelting Company, near Ogden, has been given to Willard F. Snyder, second vice-president of the Utah Mine Owners' Association, with the view of taking over the Utah plant, enlarging it and making Ogden the headquarters for the proposed independent smelting enterprise. However, other locations are being considered at points further away from farming communities.

The new zinc reduction plant at Park City, which is being constructed by the Grasselli Chemical Company, of Cleveland, Ohio, is nearing completion and the statement is made authoritatively that it will be ready for commission within 30 days. At first the plant will treat only the zinc middlings from the Daly Judge mill.

Butte

Feb. 1—The only evidence of improving conditions in the mining industry in the Butte district is the resumption of work by the Davis-Daly Estates Copper Company, which has been engaged for several weeks in pumping water from the Colorado shaft preparatory to renewing work on the crosscuts and drifts on the 1000-ft. level. An electric pump is being installed at the 1000-ft. station. The crosscuts, which have been extended several hundred feet north and south from the shaft, will be run to the limits of the company's ground, the special object being to get under the rich vein which lessees have opened in the Lizzie claim, another Davis-Daly property which lies east of the Colorado. The lessees are opening the vein at a depth of 200 ft. There is no increase in operations at any of the other mines in the district.

The Butte & Superior Mining Company has placed a $500,000 mortgage on its property in order to raise money with which to pay some of the deferred payments on options and also to provide a development fund. It is understood that something more than $200,000 is still due on the property. The Butte & Superior company is capitalized for $6,000,000.

The Raven Mining Company has cut its big vein in the Raven mine at the 900-ft. level, but no commercial ore has been found in it, though it was found well mineralized.

Indianapolis

Feb. 3—The operators and miners of the four States composing the Central Competitive Coalfield failed to go into a joint conference, as was anticipated, during the past week, but made arrangements at a final meeting to return to this city for such purpose on Feb. 27. After numerous meetings were held, it was declared that no definite action could be taken at this time toward the issuing of a call for the Interstate Wage Convention. Both operators and miners agreed that the matter could not be definitely settled at this conference, and that it would be wise to defer the meeting since both are anxious for a wage convention if one can be held under proper conditions. In the final meeting the operators suggested a postponement to Feb. 27, at which time it is hoped some of the jurisdictions—Illinois in particular—will be in a condition to enter the conference. The arrangement proved satisfactory to the officials of the Mine Workers Association and was ratified by the convention.

In the opinion of operators and miners the next joint conference will result in a call being made for a wage convention.

The purpose of delaying action is to give the different States a chance to settle what differences they may have with their miners. The Illinois operators have declared that they would join in no convention until they have obtained an understanding with their miners as to certain details in regard to next year's scale. The Illinois operators stated that they would hold a meeting on Feb. 20 and endeavor to bring about an understanding, so as to permit them to return to Indianapolis prepared to join in the convention. It developed also, that Ohio and Pennsylvania operators have some questions that they wish to settle with their miners before going into a convention. The Indiana operators expressed a willingness to go into convention at any time.

The Mine Workers convention, which adjourned Feb. 3, selected St. Louis as the place for holding the next convention. The headquarters of the association, however, will remain in Indianapolis. It is understood that vice-president T. L. Lewis has been elected president to succeed John Mitchell, and P. A. Ryan, of Illinois, secretary, to succeed W. B. Wilson. The convention has transacted a large amount of business and a number of advance steps were taken for the betterment of conditions for the miners. The proposition to establish a National Bureau of Mines was indorsed. The convention ratified a measure adopted two years ago, prohibiting members of the organization from engaging in the saloon business. There were 988 delegates in the convention, representing 1284 local unions, and entitled to 2340 votes.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

GILA COUNTY

Old Dominion—Hayden, Stone & Co. report that this mine is at present furnishing about 450 tons of direct-smelting ore daily, the average copper contents of which is about 9 per cent. To maintain this tonnage of high-grade ore necessitates a selection, due to which several of the lower-grade stopes have been wholly inactive since the era of curtailment was entered upon. The company is also shipping 300 tons daily to the concentrator, the recovery from which amounts to about 40 tons of concentrates containing 12 per cent. copper and 30 per cent. sulphur. In addition, the company is smelting from 500 to 600 tons of slag daily from the old smelter which was run solely on oxidized ores. Two furnaces are now being operated exclusively in the treatment of this slag, from which the copper is recovered at a low cost, owing to the comparatively limited coke requirements in smelting. The third and fourth furnaces are each handling about 350 tons daily of smelting mixture, consisting of ore and necessary fluxes. In addition, there is about 200 tons of flue dust and converter yard cleanings to be handled, making a total of about 1500 tons per day smelted. The aggregate output of the Old Dominion for November and December of 3,000,000 lb. was secured almost entirely from the treatment of its own ores; the custom business of late has amounted to practically nothing. Operations for this period show net monthly profits in excess of $50,000. In the development of the outlying claims, electrical power is to be supplied from a central plant, part of which has already been installed. Shaft A, the main hoisting shaft, containing four compartments, is to be extended to the 16th level.

GRAHAM COUNTY

Britt—It is reported that these mines in the Cobre Grande district have been bought by the Calumet & Arizona company, and that development work will begin at once.

PIMA COUNTY

Helvetia—The crosscut on the 300-ft. level has, according to Hayden, Stone & Co.'s report, penetrated 30 ft. into a body of 10 per cent. sulphide ore; 116 mine cars of ore from the 300-ft. level averaged 5.55 per cent. without sorting. The orebody is 30 ft. wide. From the new raise on the 200-ft. level, 66 cars averaged 15.6 per cent.

California

AMADOR COUNTY

Central Eureka—The mill has resumed operations and a few men have been put at work on this mine. The future of the mine is in some doubt, the delinquent list for the overdue assessment being quite large.

BUTTE COUNTY

The "diamond mine," discovered by M. J. Cooney and prospected for some time by him, is now to be tested by boring with a Keystone drill. The work is to be done under the auspices of the business men of Oroville. The ground to be prospected is supposed to be the same in character as occurs in the diamond fields of South Africa, "blue ground," or Kimberlite, according to Mr. Cooney.

CALAVERAS COUNTY

Mahala—A small vein of rich ore has been found in this mine at Rich Gulch, S. Redmond, owner.

Independent—J. W. Nelson and Otis Jones have applied to the California Debris Commission for a permit to run this mine near Railroad Flat by hydraulic process.

North Star—Operations on this mine, adjoining the Gold Cliff at Angels, are to be resumed.

EL DORADO COUNTY

Montauk—This mine, also known as the Zantgraf, has been sold to P. C. Drescher, of Sacramento, Cal., who will restore the mill and resume work at once.

Money—This old mine at Grizzly Flat has been bonded by W. C. Coven, who has started development work.

Sherman—Work has been resumed on this mine near Placerville with a full force of men.

INYO COUNTY

Bishop Creek—Superintendent Wilkins is now running the third hole, with the diamond drill, in the Rocky Point claim. It is being run from the face of the main tunnel. This mine is at 3500 ft. elevation.

Queens—At this property, Henry Britt, superintendent, two miles from Skidoo, two small ledges are yielding ore, running over $100 per ton. In the Good Hope, adjoining, rich ore has also been found.

Skidoo—J. H. Wilson and associates, of Skidoo, have acquired the water rights of the Burro and Quail springs and will pipe the water in some 7000 ft., for use in a 10-stamp custom mill shortly to be built.

Valley View—In this property at Skidoo, J. P. Nash, superintendent, a new ledge has been opened, of good milling ore.

KERN COUNTY

Numerous placer-mining locations have recently been made in the lower part of the Kern river cañon between the intake of the Edison Electric Company's tunnel and the power-house where the water goes back into the river. The mining is to be carried on in the bed of the river on the stretch to be left dry when the water is taken out. Some placer mining has been done at other points along the stream, but not on any extensive scale.

MARIPOSA COUNTY

Along the Merced river, there is activity in mining owing to the building of the Yosemite Valley railroad up the cañon of the river, and the development of electric power. Not only are a number of men doing placer mining at different points, but quartz mines are being opened, and at one a 10-stamp mill is being erected. Heretofore this region has been a poor one for mining, as it has been too expensive to ship machinery and supplies.

Mariposa Commercial and Mining Company—This company has leased the Queen Specimen mine near Bagby to Lindsay, Noce & Pendola, who have commenced work upon it. The company has also leased the Elizabeth mine at Corbett Creek to Jose, Morrison & Reeb, who have started development.

MONO COUNTY

Tiger—E. L. Brandon has taken an option and made a payment on this mine in Patterson district, Sweetwater mountains.

NEVADA COUNTY

Arctic Gold Mining Exploration Corporation—A strike has been made in this property near Washington, in the crosscut tunnel which taps the ledge at 300 ft. The values are good in free gold. E. A. Work, of Nevada City, and Henry Eckart, of San Francisco, are the owners.

Banner—This mine, which is being reopened after a long idleness, continues to making a good showing in the lowest level.

Lily Gold Mining Company—This company has been organized in Nevada City, with C. H. Mallen as superintendent, to develop mineral ground north of the famous Idaho mine and near the Brunswick, Grass Valley. They expect to find a continuation of the Idaho vein.

Murchie—The 20-stamp mill is running on profitable ore, and 50 men are at work at this mine. Henry Fitter is superintendent.

PLUMAS COUNTY

Hallstead—Abbott, Sorsali & Spring, of Prattville, have made another payment on the $30,000 bond on this property, eight miles from Spanish Ranch. The ledge is large and it is a low-grade proposition, but there is plenty of water and timber near-by.

RIVERSIDE COUNTY

Happy Jack—At this property, at Mecca in the Chuckawalla mountains, 39 miles northeast of Salton, the Chuckawalla Mining Company is working a large ledge of low-grade ore and the main shaft is being sunk to the 300 level. The mine is equipped with hoisting machinery and mill.

SAN BERNARDINO COUNTY

Ibex—This property near Needles, consisting of 10 claims, has been purchased by W. A. Lang and C. Ferguson, of Long Beach, Los Angeles county.

SAN DIEGO COUNTY

Cleveland Pacific Mining Company—Work is being resumed on these mines at Escondido, with W. F. Spieth, of Cleveland, Ohio, as manager. Bids are out for sinking a 250-ft. vertical shaft.

SANTA BARBARA COUNTY

The Santa Maria oilfield producers are now getting 85c. per barrel for their oil, the highest price ever paid, and it is expected that the price will advance still further. The Union Oil Company, of California, controls most of the output. This company cleared last year $2,080,771 and paid dividends of over 11 per cent. per month. The oil-land holdings now aggregate 213,354 acres, in various oil districts, 52,000 acres having been recently acquired. Half the oil of Santa Barbara county comes from the wells of this one company.

SHASTA COUNTY

Mammoth—The railroad from the Mammoth Copper Mining Company's smelter at Kennett to the mines which supply its ore is now sufficiently completed to permit the transportation of ore by rail instead of over the aërial tramway. Deliveries of ore have already been made at the smelter, and the output of the large plant will not henceforth be cramped by the inability to get sufficient ore. The mine is over 2200 ft. above the smelter, and in an air line about three miles distant. The new system of ore transportation has a daily capacity of 3600 tons, in contrast with the 800-ton. aërial tramway, which will no longer be used except in cases of emergency.

SIERRA COUNTY

Telegraph Drift Mine—Reports of an exceptionally rich strike at this mine, nine miles from Downieville, are received. Gravel running as high as $200 per mine carload has been met. The gravel was found at 22 ft. depth, in a winze in the long tunnel, but its extent is not yet known.

Colorado

CHAFFEE COUNTY

Margaret—Frank Bradbury, of Leadville, has found a rich streak of ore, 28 ft. below surface on this claim near Granite. The ore carries considerable hematite, 10 per cent. lead, some silver and a little visible gold. It is thought that the ore found in the Margaret claim is a continuation of the rich streak of ore that was struck in the old Yankee Blade property years ago. This latter mine produced ore valued at nearly a million dollars. The Margaret is surrounded by several producing mines, such as the Prudential, Raven, Trafalger and Jasper; some rich ore has been shipped from the Raven.

CLEAR CREEK COUNTY

Tip Top—This property on Pewabic mountain has been sold for $10,000 to men from Bloomington, Ill., who will install either a gasolene or electric hoist.

Sol Luna Mining and Milling Company—Articles of incorporation, showing a capital stock of $100,000, have been filed; R. C. Bonney, J. W. Boyd and Colin G. Fraser, of Idaho Springs, are incorporators. The company will operate in Gilpin and Clear Creek counties; the office will be at Idaho Springs.

Doric—It is reported that this property, at Georgetown, Colo., is to pass into the hands of the Capital Mining and Milling Company. A 100-ton mill is now being built for the latter company.

Conqueror Mining and Reduction Company—This company, operating at Empire, is arranging for the erection of a large mill to treat its ore.

GILPIN COUNTY

Square Deal Gold Mining and Milling Company—This company has taken a lease and option for $82,500 on the Two Sisters and other property in Eureka and Quartz Valley districts. New machinery is to be installed at two of the shafts. Read Shaw, of Central City, is manager.

Hampton Consolidated Mining and Milling Company—This company will install electric machinery, air compressor and drills at its property. Louis Larsen, of Central City, is superintendent.

West Notaway—Pool & Co., working a lease on the 440-level, west of the shaft, have opened up a body of smelting ore; a trial shipment assayed $180 per ton in gold, silver and copper.

Hearne Gold and Copper Mining Company—A contract for the erection of large ore bins, including grizzlies and sorting floors, has been let, as large bodies of concentrating ore have been developed. H. W. Kane, of Central City, is manager.

East Leavenworth Mining and Milling Company—Local men have organized this company with a capital stock of $100,000; they will install machinery on the property. John Hancock, of Russell Gulch, is manager.

Smuggler—This mine and 15-stamp mill in Moon gulch has been sold to people from Decatur, Ill., for a consideration of $10,000. George M. Ashmore, of Rollinsville, Colo., is manager for the new owners.

LAKE COUNTY—LEADVILLE

Fanny Rawlings—Development upon this claim, on Breece hill which is leased to T. D. Kyle, George F. Campion and others, is progressing rapidly. Mr. Kyle states that the shipping of ore will begin within a few days. A new winze is being sunk to prospect a considerable block of virgin ground. No work is now being done in that portion of the mine reached by the adjoining claim of the St. Louis company.

The suit to recover the sum of $17,000, brought by this company against the St. Louis company, has been decided in favor of the Fanny Rawlings company, and the damage placed at $17,000. It seems to be the general opinion, if not openly expressed by the lessees of this mine, that one of the rich ore shoots from the Little Jonny, which adjoins the property on the southwest, extends into the Fanny Rawlings property. About 25 men are employed at this property at present but as soon as the mine begins to ship the force of men will be increased.

Big Four—This property, which adjoins the Fanny Rawlings and the Ibex, is being worked on lease by Kyle and Fahnestock, who recently installed an electric pump. The lessees will prospect this claim as it is thought that it will prove as promising as the Fanny Rawlings. The ore already found occurs in narrow streaks but the ore is rich in gold.

Big Six—Considerable development work is being done at this claim on the west end of Breece hill. A drift is being driven to connect with the No. 2 shaft of the Penn Mining Company. This shaft, which is leased to Mr. Johns and his associates, who are working the Big Six, has been deepened 60 ft. and a station has been cut. It is the intention to hoist the ore through the No. 2 shaft, thereby greatly reducing expenses. At present about 25 men are working at this property.

Down Town Section—Among the new properties, which have just been leased, is the Starr shaft, belonging to the Western Mining Company, on East Third street. New machinery has been installed and the shaft retimbered from top to bottom; the lessees are now re-opening the drifts, which have caved since the mine was last worked. Operations will be confined to the part of the mine above water level.

Cady—Lessees are shipping, from this mine on Fryer hill, about 50 tons of silicious ore per day to the Salida smelter. Although this ore is not very rich, it is very desirable at that smelter for flux.

OURAY COUNTY

Camp Bird—According to the company report, the mill ran 29 days, and crushed 6996 tons of ore, yielding 8714 oz. bullion and approximately 474 tons of concentrate. The amount received from sale of bullion during the month was $153,631; concentrate (494 tons), $17,749; total $171,380. The cost of development, mining, transportation and treatment was $58,106; London expenses $300; profit, $112,974.

International Mining Company—A large body of ore consisting of an iron sulphide carrying silver, zinc and lead has been developed by this company on its property near Robinson. Fifty tons per day are being shipped to the smelters. The company will increase the shipments as soon as the price of spelter warrants it.

Indiana

Another extensive oilfield is to be developed in Indiana. According to the reports of the United States Geological Survey extensive pay streaks exist in Grant and Delaware counties from 280 to 300 ft. below the top of the limestone. This report is likely to direct attention to the future source of large quantities of petroleum. Plans are being made to develop the field.

GIBSON COUNTY

George W. Burton, superintendent of the Princeton Coal Mine near Princeton, was fined $1 and costs on each of two charges by Judge Sprowl, for failure to provide sufficient fireclay for use of the men in tamping their shots, and for failure to sprinkle the mine properly when ordered to do so. The prosecution was brought about by the State mine inspector under the law requiring these things under penalty. Last August two miners lost their lives by an explosion occasioned by tamping the shots with coal dust for the want of clay.

VERMILLION COUNTY

Atherton—Water has driven the miners out of the north and west portions of the Atherton coal mine near Clinton. The company has been unable to get pumps sufficient to keep the water down, and it is steadily rising, so that it is feared that it will occasion the abandonment of the entire mine. The Atherton is the finest coal mine in the field, and the company is making every effort to keep it open.

Iowa

MONROE COUNTY

Hocking Coal Company—On Jan. 25 the mine buildings of this company at Hocking were destroyed by the explosion of a carload of dynamite, which had just been received on the siding. The town was badly damaged. The shock of the explosion was felt at Albia, 3½ miles distant.

Michigan

COPPER

Arcadian—At a recent meeting of this company the old board of directors retired and an entire new board, with the exception of two members were elected. R. H. Shields, Houghton, Mich was elected president and William F. Miller, Houghton, was made secretary and treasurer. The following men compose the new board of directors: R. H. Shields; W. B. Alexander; John C. Shields; John Merten; L. W. Killmar; James W. Shields; S. J. Beahan; G. H. Russell; and S. T. Everett. It is believed that the new officers, living near the property, can give closer attention to the development than the retiring officers. The property is being explored thoroughly by means of drills and shafts. The new exploratory shaft being sunk east of the old working vein has reached a depth of about 180 ft., and when sufficient depth has been reached, crosscutting east and west will be started. In this manner a complete cross-section of the land will be obtained and it is expected that several paying lodes will be penetrated.

Osceola—This company has placed 8 additional drills for drilling at the North Kearsarge branch. At this same branch a new electric generating station is being installed.

Superior—At this property, under the management of the Calumet & Hecla Mining Company, sinking is going on below the eighth level, and in the drifts, extending from the sixth and seventh levels a very uniform grade of stamp rock is being encountered. The company has approximately 5000 ft. of openings and, in all probability, will soon enter the producing list. One of the heads at the Atlanta mill will be used.

Missouri

MADISON COUNTY

Madison Lead Company—This company is at present only running its No. 1 mill. The new No. 2 mill will be started up soon, if the ore market improves. Meanwhile development work is being pushed, and the ore reserves are being increased.

Mine La Motte—The company has just completed its new 500-ton concentrating plant, which will be the fourth mill in operation on the property. It will treat the ore from Nos. 1 and 2 shafts, besides re-treating old tailings. The concentrates are shipped at present, but the company is considering the question of starting up the Scotch-hearth smelting plant.

North American Lead Company—This company is still producing some lead, but is mainly devoted to the production of ingot copper, metallic nickel and cobalt oxide. The new smelter is in complete operation and making 4500 lb. copper and 2000 lb. nickel daily from an ore that runs 4 to 6 per cent. copper and 2 to 3 per cent. nickel and cobalt sulphides. This ore comes from the new No. 3 shaft.

Montana

BUTTE DISTRICT

Pittsburg & Montana—This company is mining about 110 tons of ore per day, which, together with 40 tons of custom ore, is being treated at the new Pittsmont smelter. About 700,000 lb. blister copper per month is being produced. The company will probably increase its smelting capacity by the addition of another blast furnace.

Parrot—The Parrot shaft is being retimbered between the 150- and 450-ft. points. No other work is being done, and nothing can be learned as to when operations will be resumed.

Butte & London—This company is pushing development work on the two most promising veins recently cut on the 1100-ft. level. Although conditions are satisfactory at the present level, it is the intention of the company eventually to sink the shaft to a depth of 1500 ft.

East Side—Lessees and small operators are busy in the neighborhood of the Braund house. Development is progressing on several properties and some ore is being shipped to the Pittsmont smelter.

LEWIS AND CLARK COUNTY

Great activity is displayed in the search for and development of mines in the well known gold districts of this county. Negotiations for the purchase of several properties in the Unionville, Rimini, Marysville and other districts are now pending. Both Eastern and local capital appears to be available for properties of merit.

Unionville—The Souvenir Gold Mining Company, composed of Butte men, has secured control of several claims in the vicinity of Springhill. The old 10-stamp mill will be renovated and put in operation; electrical power will be furnished by the Missouri River Power Company. Development work will be pushed on the 50- and 100-ft. levels.

MADISON COUNTY

Red Bluff—This district, on the east

side of the Tobacco Root and Sterling ranges, is prospering despite hard times and high charges for smelting. A Pittsburg company recently purchased the Boaz group of claims and is now engaged in sinking a 200-ft. shaft; development work will be prosecuted from this level.

Hecla group—This group on Cottonwood creek, has been purchased by California capitalists, and a 2000-ft. adit has been started to drain the old workings on the property. The Hecla is a silver mine, and was formerly worked down to the water level by shaft.

Birdie—A 700-ft. adit has just been completed on this property owned by John Stoker. It is reported that 400 ft. of this adit is in ore carrying gold, silver and copper.

Twin Bridges—Many miners of low-grade ore in this vicinity have ceased operations; others are storing the ore in bins, pending possible changes in smelter charges.

Butte & Madison Mining Company—This company in the Rochester district is now down 150 ft. with its double compartment shaft; 50 ft. more will be sunk, when a station will be cut and drifting commenced. The present showing in the mine is encouraging.

Jefferson County

Corbin—Although several companies have been forced to cease operation in this district on account of financial conditions, development work is being pushed on many of the properties Strikes of copper-gold-silver ore, which would have been sensational before the depression in mining set in, have recently been made. Considering the condition of the mining industry generally throughout the State, Corbin operators cannot complain.

Amazon—Water has driven the miners out of the 243-ft. shaft on the Robert Emmet and operations have been abandoned pending the installation of adequate pumping machinery. A wide vein carrying copper, silver, lead and gold in commercial quantities had just been cut when the work was stopped.

Sciota—Owing to the low price of copper and the present rates for smelting, little work is being done at this low-grade copper mine.

Flathead County

Libby—The Carney Mining Company is pushing work on its North Star group, on Rainy creek. The adit, which is now in 193 ft., will be driven 50 ft. further, when it is expected that the vein will be encountered. The showing in the 50-ft. shaft, sunk on the ledge, is good.

Fergus County

Barnes-King—The annual report of the Barnes-King Development Company shows that the existing debt on Jan. 1 was $32,610, most of which was ordinary current expenses. The capital stock of the company is $2,000,000, of which $200 was paid in cash and $1,999,800 in property. The report is signed by John Gillie, president, and J. H. Case, D. J. Hennessy, L. O. Evans and C. W. Goodale, directors.

Nevada

Esmeralda County—Goldfield

During the last six months of 1907 both from leases and from company work the Black Butte sold 320 tons; Combination Fraction, 434; Consolidated, 71,136 tons; Daisy, 69; Florence, 8720; Jumbo Extension, 14,373; May Queen, 9; Sandstorm, 21; St. Ives, 218; and Velvet, 11 tons. The Goldfield Mine Owners' Association has abolished the card system, which required all employees to sign an agreement renouncing the Western Federation of Miners; this was done because the agreement among the employers to make the employees sign such a renouncement was illegal according to the laws of Nevada. In the future the applicants for employment "will only be required to satisfy the secretary of the association and the employers of their competency and reliability." Henceforth, the secretary of the association states, the mines at Goldfield will operate upon an open-shop basis and employ miners regardless of their membership in any union.

Goldfield Consolidated—The Combination mill is running full time, treating about 90 tons per day. Development work is being done in the mine as well as stoping. At the Mohawk, the shaft is being sunk and development is continued in the lower levels. The ore coming from this work is being stored. About 35 men are grading for the new mill. A breaker for crushing the rock to be used in the concrete foundations has been installed. Few leases on the Consolidated properties are at present being worked. Apparently the Gotwaldt lease on the Combination No. 1 will soon begin shipping for, at a depth of 94 ft., the vertical shaft has cut a vein apparently the extension of the vein which paid so well in the old Reilly lease.

Florence Goldfield—The present production of the company is coming entirely from the leases. The company's mill will be running in about three months.

Florence Annex—The development on this lease still continues to be in good ore.

Gem—This lease on the Cornishman claim has begun to ship ore from the vein on the 150-ft. level, which is 3 ft. wide. Driving continues on the 150-ft. level and the shaft is being sunk to a depth of 250 ft. where a crosscut will be driven.

January Jones—At this lease, also on the Cornishman claim, sinking has been resumed in the shaft, which will be sunk to a depth of 400 ft.; at present it is 300 ft. deep.

Florence Jumbo—A 25-h.p. hoist has been installed.

Kendall—In the Garrett lease on this property much milling ore has been developed, some of which is now being treated at the Kinkead mill.

Daisy—Driving is being done on the 400-ft. level; 17 men are working at the property.

Nevada California Power Company—This company has made a reduction of about 20 per cent. in its rates to residences and 33⅓ per cent. for large consumers. The present price is 20c. per kilowatt and when over 50 kw. are used in one month 18c. per kilowatt.

Lyon County

Dredging near Dayton—J. J. Hill and others, of Oroville, the center of dredge mining in California, are about to take steps to begin dredging the Carson river near Dayton. The place has been examined and is considered favorable for this class of mining. The same region was dredged years ago, at a point where the river is very wide, but owing to crude devices no marked success resulted. With the modern dredge, however, it is considered feasible to mine the bed of the river profitably by this process.

Wabuska-Yerington Railroad—W. J. Orem, who, with his associates, controls the Nevada Douglas and Ludwig copper mines at Yerington, announces that a broad-gage railroad will soon be built from Wabuska to Yerington and the Nevada Douglas and Ludwig mines, and that a smelter which will give employment to 500 men will be constructed at the Ludwig. He states that Eastern capital is back of the project.

Nye County—Rhyolite

National Bank—R. W. Sparling, of Goldfield, has taken the contract to treat 1000 tons of ore from the mine dump. He will erect a 30-ton mill which he plans subsequently to run as a custom mill. The ore will be crushed in a Tetrault crusher and a Wallace grinder; amalgamation and concentration will be used. If necessary cyanidation will be used on the tailing. There is a large tonnage of milling ore on the dump at this mine.

Gold Bullfrog—Additional tanks and new classifiers are being installed at the mill. A compressor will be installed at the mine. At the mine the raise to surface has been completed and a 25-h.p. hoist is being placed in position. Sinking will then begin.

Montgomery Mountain Mining Company—At the meeting of the stockholders it was decided to increase the capital stock by 250,000 shares, making the total number of shares 1,500,000. There will also be a bond issue to raise money for resuming development work. It is reported that Samuel Newhouse and associates have underwritten this bond issue. This company owns claims covering about one-half of Montgomery mountain near

the Montgomery Shoshone properties. M. M. Johnson, chief engineer for Samuel Newhouse, is consulting engineer to this company.

Homestake — Development work has been resumed on four of the six levels. About 34 men are working on the foundations of the mill. The mill is to be built on a steep hillside and will be 300 ft. long. The range in elevation will be about 250 ft.

NYE COUNTY—TONOPAH

The Tonopah company sent 3000 tons, the Belmont company 830 tons, the North Star 91 tons and the Montana-Tonopah 1100 tons to the mills, making the total shipments for the week 5021 tons. The Belmont mill was closed down for two days during the week, to make connection with the Nevada California Power Company, whose power it will use from now on. The amount of ore handled by the mill was on that account somewhat curtailed.

Montana Tonopah—Much prospecting is being done on the 2d, 3d, 4th and 5th levels. On the 4th or 600-ft. level, in the crosscut driven south from the MacDonald drift, near the line of the Midway Fraction and Lucky Jim claims, a vein has been cut which is thought to be an extension of the Martha vein. This vein has an east-west strike and dips to the south. The ore is 6 to 7 ft. wide and of good milling grade. In the Macdonald drift on the same level the faulted portion of another vein was found; this ore is a sulphide. No development is being done on the wide vein recently found on the 765-ft. level owing to poor ventilation on that level.

Tonopah Extension — The work of building the 40-stamp mill will begin within the next few weeks. The drift on the 1050-ft. level, below the dacite intrusion, has not yet reached the sought-for vein.

North Star—Considerable ore is being mined from the 950-ft. level; this is being sent to the Montana Tonopah mill. The drift on the 1250-ft. level, following the fault, is being advanced.

Tonopah Midway — Development work is being done on the 300-, 400- and 500-ft. levels. The ore being mined comes mainly from the 400-ft., or more properly the 435-ft., level. In the crosscut south of the shaft on that level several stringers of ore have been found and a raise has been driven on one of them to a hight of 25 ft. The winze from the 835-ft. level is now 100 ft. deep. A station is being cut so as to develop the vein at that point; the winze will then be sunk another 100 ft. This winze is being sunk in the footwall. This vein occurs below the dacite intrusion. Ore shipments have been temporarily suspended until better arrangements can be made with the smelters.

West End Consolidated—On the 200-ft. level prospecting work is being done. Several men are at work, outlining the apex of the vein. About 25 men are employed at the property. The usual tonnage is being mined from the 400-ft. level.

MacNamara—High-grade ore has been found in two places west of the stopes from which ore was formerly shipped. Much work is being done on the 300-ft. level about 600 ft. west of the shaft and about 200 ft. from the west end-line of the property. A raise, now 80 ft. high, has been driven, all in high-grade ore. Another raise has been started about 35 ft. east of this raise and the high-grade ore has also been cut by it. Another shift has been added and now 17 men are working at the property. Three air drills are being used.

Belmont—The ore in the south vein on the 800-ft. level is from 3 to 3½ ft. wide. On the 700-ft. level, a crosscut is being driven to find this vein. Ore is being mined from the Mizpah vein in the stopes of the 800-ft. and 900-ft. levels. On the 900-ft. level a crosscut is being driven to find the south vein. On the 1000-ft. level a crosscut toward the north is being driven to catch what is called the north vein, which is narrow but from which some rich ore was mined on the 900-ft. level.

WHITE PINE COUNTY

Giroux—It is reported that inspection has shown that it will be very difficult, if not impossible, to use the Alpha shaft in working this property, for the shaft has been badly wrecked by the cave last December, which imprisoned the miners.

New Mexico

GRANT COUNTY

Alabama Group—W. B. Bates has taken an option on this group of five claims which have been worked for turquoise. The present operations will be carried on for copper and gold.

Southwest Smelting and Refining Company—An increasing tonnage of custom ore is coming to the smeltery. The company is preparing to move its diamond drill to the Iron Mask. The Valley shaft has been closed temporarily and the output from the By Chance has been doubled.

SANTA FE COUNTY

Santa Fe Gold and Copper Company—At the annual meeting held in Boston, Mass., Jan. 28, the treasurer's report for the year ending Dec. 31, 1907, showed that the products of the San Pedro mines sold during the year were 1,000,000, lb. copper, 57.4 lb. per ton of ore, 17,625 oz. silver and 786 oz. gold. It is reported that the company is preparing to resume operations at the San Pedro. The properties were closed down several months ago, a limited force of men being kept at work cleaning up, installing new machinery and extending the development of the mine.

Ohio

BELMONT COUNTY

Summit Coal Company—This company is preparing to start up its mine at Flushing, which has been idle for nearly a year. About 200 men will be employed.

Pennsylvania

ANTHRACITE COAL

Philadelphia & Reading Coal and Iron Company—This company's statement for December and the six months of the fiscal year from July 1 to Dec. 31 is as follows:

	December.	Six Mos.
Earnings	$3,758,446	$21,022,009
Expenses	3,435,756	19,244,747
Net earnings	$ 322,690	$ 1,177,262

For the six months gross earnings increased $3,029,760; expenses, $2,147,538; and net earnings $882,222, or 98.6 per cent.

BITUMINOUS COAL

John Barnes, of Philadelphia, and associates, have bought a tract of 500 acres of coal land on Ramsay's run in White township, Indiana county. They propose to develop the tract at once.

South Dakota

LAWRENCE COUNTY

Hercules—Superintendent Englehardt is doing some extensive development of old orebodies on portions of the property in the Galena district. On Ruby gulch a shaft has been sunk 125 ft. and drifting from two levels is being done.

Vallier — Development work on the ground on Polo creek has opened up large intrusions of porphyritic trachite that carry gold of a milling character.

Washington Consolidated—It is announced that George Huston, of Mullan, Idaho, will shortly take up his option on this property in Galena, and with Eastern interests will commence operation some time this spring.

PENNINGTON COUNTY

Crown—Free gold has been found some distance below the surface. A 10-stamp mill, it is expected, will be put up this spring to treat the ore.

King Oscar — The three-compartment shaft has reached a depth of 50 ft. and shows good prospects in both gold and copper. The new plant will be in operation about May, when development will be more extensive.

Storm Mountain—New shafts are being sunk on a number of gold-ore ledges that are exposed for some distance across the property.

Texas

MILAM COUNTY

Two new lignite mines have been opened on the line of the Santa Fe road,

near Cameron. The quality of the coal is said to be good.

Virginia

Pocahontas Consolidated Collieries Company—With regard to the application for a receiver for this company, recently noted, Vice-President Charles S. Thorne furnishes the following statement: "The suit is simply an attempt of a small number of security holders to obtain a cash appraisal of their stock; no date had as yet been set for the hearing. The company was formed by a merger, July 1, 1907, of the Pocahontas Collieries Company under the name of the Pocahontas Consolidated Collieries Company, Inc., with $2,800,000 preferred stock and $4,500,000 common stock and an authorized bond issue of $20,000,000, of which $4,000,000 bonds have now been issued. A small minority of the preferred stockholders of the Pocahontas Collieries Company did not exercise their privilege to exchange their stock for bonds, which were offered and accepted in this merger by all the other stockholders. Of this minority, 214 shares, $21,400 in amount, have filed a bill asking the court to appraise the value of their securities; or, failing to get this relief, to appoint a receiver for the company. Such an appraisement is provided for under the statute of Virginia, and was anticipated by the management of the company from the beginning, and can in no way disturb the securities or credit of the company. There is no question involved as to the financial condition or standing of the Pocahontas Consolidated Collieries Company, as it has no debts that are due, has paid all current bills to Dec. 31, 1907, and paid its bond interest and preferred stock dividend on Jan. 1, 1908, and in addition recently paid a dividend of 6 per cent. per annum on its common stock and is in a stronger financial condition than was either of the companies, of which it was formed, prior to the merger. The company is doing an active business. Its coal is sold through Castner, Curran & Bullitt, of Philadelphia, and its coke is handled by the Pocahontas Coke Company, of Bluefield, West Virginia."

West Virginia

Marion County

Fairmont Coal Company—Work was resumed Jan. 27 in No. 8 mine at Monongah, where the disastrous explosion of Dec. 6 last, occurred. The repairs are sufficiently advanced to permit the resumption of work, though there is still considerable work to be done.

In repairing the mine a great many of the workmen's tools were recovered. As it is impossible to identify these tools so as to deliver them to the families of the proper persons, the Fairmont Coal Company decided to purchase all of them, the money to be paid for them to be turned into the relief fund. This will insure a more equal distribution of the value of this property than any other means. The tools will be appraised by representatives of the company and the relief committee.

Canada

Ontario—Cobalt District

Ore Shipments—Shipments of ore for the week ending Jan. 25 were as follows: Coniagas, 66,470 lb.; Foster, 40,000; La Rose, 300,000; McKinley-Darragh, 120,000; Nipissing, 64,000; Standard, 39,730; Silver Queen, 243,000; Silver Cliff, 52,000; Temiskaming, 59,400; total, 984,600 pounds.

Cleveland—Col. O'Neil Gordon has resigned as general manager of this mine.

Erie Cobalt Silver Mining Company—The annual meeting of this company was held in Toronto, Jan. 27. Reports presented showed the expenditure of $49,000 during the year on development work and that the company had on hand low-grade ore, the value of which was estimated at from $50,000 to $60,000. A proposal for the installation of additional modern mining machinery was adopted.

McKinley-Darragh—Capt. John Harris, who has been superintendent since July 1, 1907, has resigned his position.

Mexico

The committee appointed by the Department of Fomento to draft new mining laws has completed its labors, and although its report has not yet been made public, it is believed to embody recommendations for radical changes in the present regulations. An important modification is said to give equal privileges for all prospectors. Hitherto it has been the custom to allow men of means to cover large territories of promising country by what are known as "blanket denouncements." According to the recommendations privileges for exploitation of mineral regions will no longer be granted to persons who have no intention of carrying on mining operations.

Chihuahua

Prieta—An electric tram is being installed between this mine and the loading platform of the Parral Mining Company.

Otates Mining Company—This California corporation, capitalized at $100,000, and composed chiefly of English capitalists, has taken over on a working bond the silver mine of Jesus Solis at Los Otates.

Parral Ore Production—Parral is not so quiet as has been reported. Much development work is under way, and production of ore in the camp during the week ending Jan. 18 amounted to 9060 tons. Of this 3360 tons was shipped to smelters and 5700 tons was treated locally.

Durango

El Carbon—Rich ore was recently encountered in this mine near Canelas; five tons of the ore recently shipped is said to have netted $10,000.

Guanajuato

El Roble—J. C. Corwin, of the Corwin & Green Mining and Milling Company, has purchased 160 acres of land lying parallel with the Santa Ana river, adjoining the El Roble and the San Cayetano and American Mining and Milling Company properties. The tract includes the town of San Cayetano, and will furnish space for dwelling houses and surface works for the El Roble mine. The first carload of bonanza ore was shipped recently.

Pinguico—This mine is continuing the development of its high-grade orebody. The mills of the Pinguico Mines Company, the Peregrina Mining and Milling Company and the Mexican Milling and Transportation Company, operate 220 stamps in all and treat 1000 tons of ore per day. The extraction averages about 90 per cent. The Guanajuato Development Company is receiving about $80,000 worth of gold and silver bullion per week from its subsidiary companies.

Guerrero

Mitchell Mining Company—George Mitchell, ex-president of this company, has, in a circular sent to the stockholders, answered the charges of mismanagement brought against him in a letter issued by the "Re-organization Committee" on Oct. 27, 1907. The delay in replying to the five charges was caused by illness. Mr. Mitchell denies as untrue the charges of extravagance and appropriation of company funds, and gives reasons for certain transactions which the committee considered irregular and objectionable.

Jalisco

San Pablo Mining Company—This company, of New York, has secured bonds for a period of three years on the Mil Pesos, San Pedro and Patrocinio mines in the Etzatlan district not far from the town of Ahualulco. The mines are below the San Pablo properties on the same mountain. The working force will be increased and an adit which now extends into the San Pedro property for 300 ft. will be extended 500 ft. into the San Pablo property, cutting 300 ft. below the present workings.

San Luis Potosi

Montezuma Mining Company—A new vein, rich in silver and gold, has been struck near the 600-ft. level of the old Bernalejo mine at El Salada, south of San Luis Potosi. The mine is equipped with modern machinery and is under the supervision of J. V. Dignowity, Jr., and S G. Etherington. The company has shipped a carload of lower-grade ore.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Feb. 5—The bituminous coal trade in the East continues quiet, owing to the closing of factories, and the consequent light demand for steam coal. Moreover, many large concerns, especially in New England, put in stocks in anticipation of active business, and have now coal enough to carry them a long time under present conditions. The coastwise trade is exceedingly dull, much more so than is usual at this season.

The anthracite trade is quiet; even the cold weather of the past week has not been able to stir up any special activity, through domestic trade is a little better.

In the West conditions are unchanged, and steam coal continues in small demand. Many mines are running on part time and production is generally light for the season.

The conference at Indianapolis last week was without definite result. No agreement as to a renewal of the Interstate Agreement was reached, chiefly because the representatives of the operators were not prepared to make definite propositions. It was decided finally to hold another meeting on Feb. 27, when the operators expect to have instructions from their respective districts.

Coal Traffic Notes

Tonnage originating on Pennsylvania Railroad lines east of Pittsburg and Erie, year to Jan. 25, in short tons:

	1907.	1908.	Changes.
Anthracite.....	379,473	353,966	D. 25,507
Bituminous.....	2,775,956	2,237,985	D. 537,971
Coke.....	971,233	457,999	D. 513,234
Total.....	4,126,662	3,049,950	D. 1,076,712

Average daily tonnage 158,718 in 1907 and 121,998 this year.

Coal shipments from the Chesapeake & Ohio terminal at Newport News, Va., for the full year were, in short tons:

	1906.	1907.	Changes.
Coastwise.....	2,938,555	2,862,951	D. 75,604
Foreign.....	346,002	603,328	I. 257,326
Total.....	3,284,557	3,466,279	I. 181,722

The increase in exports was 74.4 per cent.; in total shipments, 5.5 per cent.

Coastwise shipments from Atlantic ports, 11 months ended Nov. 30, long tons:

	Anthracite.	Bitum.	Total.	PerCt.
New York....	15,324,008	10,691,066	26,015,074	64.3
Philadelphia	2,186,507	4,686,804	6,873,311	17.0
Baltimore....	236,856	3,487,585	3,724,441	9.2
Newp't News	.....	2,196,352	2,196,352	5.4
Norfolk.....	.....	1,655,044	1,655,044	4.1
Total.....	17,747,371	22,716,851	40,464,222	100.0
Total, 1906.	14,564,563	20,643,196	35,207,759	.....

Increase in 1907 was 5,435,437 tons, or 15.4 per cent.

Coal receipts at St. Louis, 11 months ended Nov. 30, were 6,840,760 short tons in 1906, and 7,413,151 in 1907; increase, 572,391 tons.

The coal bunkered, or supplied to ships engaged in foreign commerce at United States ports for the 11 months ended Nov. 30 was 5,173,758 long tons. Added to the exports, this makes a total of 17,319,474 tons sold for consumption beyond the limits of the United States.

New York

Anthracite

Feb. 5—The hard-coal market has not strengthened to any extent during the past week and both prepared and small steam sizes are in good supply; if any scarcity exists it is in egg and pea coal. The cut in prices among independent dealers, which was noted last week, still prevails. The circular prices are quoted as follows: Broken, $4.75; egg, stove and chestnut, $5; pea, $3.25@3.50; buckwheat No. 1, $2.75@3; buckwheat No. 2 or rice, $2.15@2.25; barley, $1.75; all f.o.b. New York harbor.

Bituminous

The soft-coal market is dull and has not recovered from the recent depression. The roads carrying coal to tidewater are at present very much congested and coal is being moved slowly and with many delays. This does not, however, have the effect of strengthening the market; consumers are indifferent and are stocked sufficiently to take care of their comparatively small requirements.

In New England, factories are consuming only a small proportion of their usual tonnage; shipments are, therefore, very light to this territory. In New York harbor business is almost at a standstill. Good grades of Clearfield can be bought for $2.50, while West Virginia sells for $2.20 up.

Little can be said concerning the coastwise trade, since charters are few and far between. Contracts can be made at practically the shipper's own terms. Quotations of freight rates are nominally 65@70c. around the Cape.

Birmingham

Feb. 3—State Mine Inspector J. M. Gray will during the week announce the official output of coal in Alabama during the year 1907. It is believed that the figures will show an output of nearly 14,000,000 tons. The production in 1906 was near 13,000,000 tons. Had there not been a decided change in conditions the last of the year the production for the year would have gone up to near 15,000,000 tons.

There is a fairly good demand for coal and prices have not dropped. The coke production is at a low ebb. None of the coke ovens of the Tennessee Company at Bessemer, near Birmingham, are in operation. The commercial coal companies report steady operations at their mines; but the larger coal producers are the iron companies, and they have no use for the usual quantity now, though prospects are bright for an early resumption of all operations.

Chicago

Feb. 4—Owing to cold weather, trade has become considerably better in both bituminous and anthracite. Domestic kinds especially have profited from the change. Steam coals still suffer from general lessening of manufactures. Production of nearly all bituminous coals is still heavy as compared with the demand, but with continued cold weather the Chicago market can absorb about all the coal it is now getting and make no complaint, generally speaking, about demurrage charges.

Coal from Illinois and Indiana mines brings $1.90@2.50; run-of-mine $1.60@1.80 and screenings $1.20@1.40. Hocking is stronger on account of the weather, and brings $3@3.15. Smokeless is recovering from the over-supply of a week ago, New River and Pocahontas bringing $3@3.25 for run-of-mine. Youghiogheny is in light demand and abundant supply at $3.15 for ¾ in. gas. Pittsburg No. 8 sells at $2.80, with no large demand.

Anthracite has perhaps profited most from the weather, sales being brisk, but not for large individual orders; all sizes of anthracite are in good supply.

Pittsburg

Feb. 4—Demand has increased somewhat and prices continue firm on the basis of $1.15 a ton for mine-run coal at mine. Owing to the idleness of many mills production is low, not more than 40 per cent. of the railroad coal mines being in operation this week. The river mines are practically in full operation. Slack continues strong, the minimum quotation being 80c. No large contracts for the year are being closed and it is not likely

that anything will be done until there is a settlement of the mining rate.

Connellsville Coke—Another decline is noted this week. Furnace coke for spot shipment has dropped to $1.65 and on contract $1.85@1.90 can be done. It is reported, but not confirmed, that a fairly large contract was taken within the past few days at $1.75. Foundry coke, which has been strong since the opening of the year, has declined and quotations on both spot and on contract are $2.35@2.50. The *Courier*, in its weekly summary, gives the production in both regions at 208,762 tons. The shipments aggregated 5841 cars, distributed as follows: To Pittsburg, 2689 cars; to points west of Connellsville, 2738 cars; to points east of Connellsville, 414 cars.

Foreign Coa Trade

Exports of coal and coke from the United States for the year ended Dec. 31 were as follows, in long tons:

	1906.	1907.	Changes.
Anthracite	2,216,969	2,698,072	I. 481,103
Bituminous	7,704,850	10,448,676	I. 2,743,826
Total coal	9,921,819	13,146,748	I. 3,224,929
Coke	765,190	874,689	I. 109,499
Total	10,687,009	14,021,437	I. 3,334,428

These figures do not include coal furnished to steamships in foreign trade.

Imports of coal and coke for the year were as follows:

	1906.	1907.	Changes.
Coal	1,744,507	2,126,018	I. 381,511
Coke	128,461	132.355	I. 3,894
Total	1,872,968	2,258,373	I. 385,405

Of the coal imported in 1907 there was 9896 tons classed as anthracite. The larger parts of the imports are on the Pacific coast.

Iron Trade Review

New York, Feb. 5—Business continues dull, with some small exceptions. In pig iron, trade has been all in small orders, of which the pipe foundries have furnished the larger proportion. There is still talk of shading prices, though it is understood that there is a general agreement among the furnaces, both in the East and the West, to maintain the present quotations; while in the South makers are trying to hold them also.

In finished material little new business is coming forward, except in structural material. Some bridge contracts have been let; and quite a number of building contracts have been let or are under negotiation. Most of these are in New York and vicinity. Some of those let have been taken at prices so low that they involve lower cost of material.

The meeting of the advisory committee in New York last week was supplemented by a general informal gathering of the trade. It was decided to continue the policy recently adopted, and to hold prices at the present level for all finished steel products. It is understood that there was a general agreement on this point, so that no reductions are probable, at least for a time.

While steel quotations are to be held, some lively cutting is reported in iron bars, and all sorts of quotations are being made, both by eastern and western makers.

Birmingham

Feb. 3—While there has been no extraordinary activity in the pig-iron market in the Birmingham district during the past week the conditions show improvement. Southern manufacturers are holding at $13.50 per ton, No. 2 foundry. There will be no decrease in price, as far as can be seen ahead, even on the part of the smaller manufacturers. Quite an amount of iron has been sold already for future delivery, especially during the next two months, and some healthy inquiries are being received. The local consumption is improving slowly. The Bessemer rolling mills, of the Tennessee Coal, Iron and Railroad Company, are again in operation, with several hundred men employed. Two furnaces will be blown in by Feb. 15. The iron in yards is being worked down slowly but surely. The cast-iron pipe makers have good orders on hand and in sight, and have made arrangements for their needs in iron for some time ahead.

Chicago

Feb. 3—The market for pig iron continues light, with little disposition to buy on contracts. Users of iron are still waiting on financial developments and caution is everywhere apparent. On the part of furnace representatives the same spirit of waiting is apparent. Small production and small consumption are looked for until the general tone of business shall have become better.

Southern iron brings $13@13.50, Birmingham, and Northern iron $17.75@18.25 on small lots for delivery within the first quarter. Northern charcoal iron finds light sales at $22@22.50.

The inquiries from large concerns indicate a possibility of increasing business. Tonnage on quick delivery orders is increasing a little. Iron and steel products show little improvement, the railroads holding off generally from purchases and building operations being still in abeyance.

Coke is in very light demand and supply, at $5.25 for the best Connellsville.

Philadelphia

Feb. 5—A moderate improvement has taken place in pig iron. The smaller buyers have been making cautious purchases, but the larger interests are only talking about buying and no transactions are probable on a large scale. The renewal of the understanding as to pig-iron prices by the Eastern Association for 30 days is merely a makeshift until the situation clears up. The Southern iron-makers are in a position to cause a good deal of trouble. The margin of profit will not permit of any reduction unless cheaper ore and cheaper coke can be had. The local demand is confined largely to foundries. Very little forge iron has yet been asked for, and the bar mills are not caring to enter into large contracts at present. Prices are not strong, but the makers cannot offer any inducements to large consumers and are simply waiting developments.

Bars—Prices continue nominal, but it is expected that the next meeting will establish a parity between merchant and steel bar. A fair business is being done at the stores.

Scrap—The low level to which scrap fell brought out a number of buyers and everything in the shape of heavy steel scrap has been picked up and offers have been made to the scrap dealers to take more of the same, if it can be furnished at the same prices. Other lines are slightly more active.

Pittsburg

Feb. 4—The only event of interest during the week was the reaffirmation of prices of finished steel products at the New York meeting of representatives of the large concerns of the country. All who attended the meeting from this district express satisfaction over the action taken, but so far no material benefit has resulted. Small orders in different lines are being placed. Specifications are coming in a trifle more freely and this may be due to the fact that further delay would not prove to be of any advantage. There is no material change in the operation of the mills in this and surrounding districts, except that three additional mills at the Homestead plant of the Carnegie Steel Company resumed yesterday and the plant is now practically in full operation. The Edgar Thomson rail plant is still running on about half time. A report that large orders for rails had been placed by the New York Central is denied.

Pig Iron—The pig-iron market is irregular. Despite the efforts of the large producers to keep up prices, all sales during the week have been at the low quotations made a week ago. At a meeting of producers recently it was decided to maintain $18 for bessemer, $17 for basic and No. 2 foundry, and $16 for gray forge. Sales of bessemer and No. 2 foundry were at $1 a ton less and no transactions in basic or gray forge are recorded. A meeting of furnacemen to consider ore prices was arranged to be held here today, but for some reason it

was postponed. The action taken at the New York meeting, which provides for a continuance of last season's prices, is meeting with considerable opposition. It was expected that some of the independent ore producers would announce prices this week, but so far as learned it was decided to defer action for about two months. The present ore prices are as follows: Old Range bessemer, $5; Mesabi bessemer, $4.75; Old Range non-bessemer, $4.20; Mesabi non-bessemer, $4 per ton.

Steel—Both bessemer and open-hearth billets remain at $28 and sheet bars at $29. Plates are unchanged at 1.70c., and merchant steel bars at 1.60c.

Sheets—No new business of any consequence is being placed and prices remain unchanged, black sheets being quoted at 2.50c. and galvanized at 3.55c. for No. 28 gage.

Ferro-Manganese—Prices have dropped to $48 a ton, a sale of 100 tons having been made today at that price.

Metal Market

Gold and Silver Exports and Imports

NEW YORK, Feb. 5.
At all United States Ports in Dec. and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Dec. 1907..	$ 1,004,441	$44,448,509	Imp. $43,444,068
" 1906..	1,880,895	7,617,237	" 5,736,342
Year 1907..	55,215,681	143,398,066	" 88,182,385
" 1906..	46,709,158	155,579,380	" 108,870,222
Silver:			
Dec. 1907..	4,407,485	4,315,452	Exp. $92,033
" 1906..	7,404,905	3,999,269	" 3,405,636
Year 1907..	61,619,653	46,005,776	" 15,613,877
" 1906..	60,957,091	44,227,841	" 16,729,250

Imports of gold at New York for the week were $783,483, of which $466,500 were from Cuba; of silver $233,571, chiefly from Mexico. Export of gold were $1500; of silver, $1,020,971, chiefly to London.

The Treasury Department estimate of the money in the United States on Feb. 1, 1908, is as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury)	$ 176,888,590	$ 641,496,096
Gold certificates	40,586,510	769,629,359
Silver dollars	8,588,890	89,557,092
Silver certificates	11,290,360	453,413,640
Subsidiary silver	10,816,738	130,701,055
Treasury notes of 1890	7,516	5,392,484
U. S. notes	7,509,361	339,171,655
Nat. Bank notes	30,401,444	665,001,318
Total	$286,089,409	$3,094,362,699

Population of the United States, Feb. 1, 1908, estimated at 86,903,000; circulation per capita, $35.61. For redemption of outstanding certificates an exact equivalent in amount of the appropriate kinds of money is held in the treasury, and is not included in the account of money held as assets of the Government. This statement of money in the treasury as assets of the Government does not include deposits of public money in national-bank depositories to the credit of the treasurer of the United States, amounting to $226,241,409. The total amount in circulation Feb. 1 was $15,373,401 more than on Jan. 1; and $191,460,603 more than on Feb. 1 last year.

Silver Market

SILVER AND STERLING EXCHANGE.

Jan.-Feb.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	Feb.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
30	4.8710	55 3/8	25 1/16	3	4.8660	55 1/2	25 1/16
31	4.8715	55 1/4	25 1/2	4	4.8665	55 1/2	25 5/8
1	4.8690	55 1/2	25 1/16	5	4.8650	55 1/4	25 1/2

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Silver is quiet, with no special tendency. The market seems to have steadied itself around 25½d. London stocks have been distributed, and any large buying order would advance the price.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to Jan. 23:

	1907.	1908.	Changes.
India	£ 296,510	£ 298,000	I. £ 1,490
China	.....	91,000	I. 91,000
Straits	.....	.....	.....
Total	£ 296,510	£ 389,000	I. £ 92,490

Receipts for the week were £138,000 from New York. Exports were £32,950 to India and £10,000 to China; £42,950 in all.

Indian exchange has been slightly firmer, and the Council bills offered in London brought an average of 15.91d. per rupee. Buying of silver for Indian account has improved slightly.

Mint purchases of silver: Jan. 29, 200,000 oz. at 55.975c., deliveries New York and Philadelphia.

Other Metals

Jan.-Feb.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
30	13¾ @13⅞	13⅝ @13¾	61⅛	28	3.70 @3.75	4.55 @4.60	4.40 @4.45
31	13¾ @13⅞	13⅝ @13¾	61⅛	28	3.70 @3.75	4.55 @4.60	4.40 @4.45
1	13⅝ @13¾	13½ @13¾	.....	28	3.70 @3.75	4.60 @4.65	4.45 @4.50
3	13⅜ @13¾	13½ @13⅝	61	28½	3.70 @3.75	4.65 @4.70	4.50 @4.55
4	13⅝ @13¾	13¾ @13⅞	61⅛	29⅛	3.70 @3.75	4.65 @4.70	4.50 @4.55
5	13⅝ @13¾	13⅜ @13⅝	62	28¾	3.70 @3.75	4.70 @4.75	4.55 @4.60

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b's. The New York quotations for electroytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The market has been almost lifeless throughout the week. Small quantities of the metal were marketed in Europe, but the sales there could be effected only at concessions in price. Domestic consumers did practically nothing. The market closes easy at 13⅝@13¾c. for Lake, and 13⅜@13⅝c. for electrolytic in ingots, cakes and wirebars. Casting copper has been nominal at 13¼@13½c. as the average for the week.

At the beginning of the week the standard market in London declined sharply, but since there has been a reaction, and the close is practically unchanged at £62 for spot, £62 10s. for three months.

Statistics for the second half of January show a decrease in the visible supplies of 200 tons.

Refined and manufactured sorts we quote: English tough, £57@58; best selected, £65@66; strong sheets, £68@69.

Exports from New York and Philadelphia for the week were 7126 tons. Exports from Baltimore are given by our special correspondent at 628 long tons.

Copper Sheets and Wire—The base price for sheets is 20c.; wire, 16¼@16½c. per pound.

Tin—A concerted bull movement has brought about a very considerable advance in the London market, which at the close is cabled at £129 for spot, £129 5s. for three months;

Prices in this market have followed the advance abroad, without, however, arousing consumers from their lethargy, and the business which has taken place has been for immediate delivery and for retail lots only. Spot tin is still rather scarce and commands a premium. The price quoted in this market is about 29c. per lb.

Statistics for the month of January show an increase in the visible supplies of 2300 tons.

Tin stocks in sight Feb. 1, in long tons:

	In Store.	Afloat.	Total.
London	6,035	4,463	10,498
Holland	1,975	187	2,162
United States	826	1,500	2,326
Total	8,836	6,150	14,986

The stocks in the United States do not include those at Pacific ports. The total stocks show an increase of 2928 tons over Jan. 1.

Lead—A fairly steady business, although of small proportions, is taking place at unchanged prices, 3.70@3.75c. New York.

The London market, after the recent spurt, has flattened out and the close is cabled at £14 12s. 6d. for Spanish lead, £14 15s. for English lead.

Spelter—Even though the business from consumers is of small proportions, the market has improved because production is being curtailed right along owing to the scant supply of ore. Prices being paid for ore are relatively higher than

the spelter market, so that smelters are inclined to hold on to their metal as long as possible rather than sell below cost. The close is firm at 4.70@4.75c. New York, 4.55@4.60c. St. Louis.

The London market is gradually losing all of its recent improvement, and closes at £20 5s. for good ordinaries, £20 10s. for specials.

Zinc Sheets—The base price is $7 per 100 lb.—less discount of 8 per cent.—f.o.b. cars at Lasalle and Peru. The freight rate to New York is 27.50c. per 100 lb.

Antimony—The market is quiet and substantially unchanged as to prices. Some business is being done for spot delivery, but futures are nearly neglected. The foreign markets are practically the same as in New York. Quotations are 9¼@9½c. for Cookson's; 9@9¼c. for Hallett's; and 8½@8¾c. for ordinary brands.

Aluminum—The current price for No. 1 ingots, in ton lots, is 33c. per lb. For rods and wire, No. 0000 to 10, base price is 38c. For sheets, No. 13 to 24, B. & S. gage, base price is 40c. Tubes, 1¼ to 3½ in., base 50c. Higher prices are charged for small lots.

Platinum—The market is quiet and without any special features. Quotations remain unchanged at $28 for hard platinum, $25.50 for ordinary, and $17 for scrap. Prices are per troy ounce.

Cadmium—The price is $1.25 f.o.b. Cleveland in 100-lb. lots. A higher price is asked for smaller lots.

Nickel—For large lots, New York, the chief producer quotes 45@50c. per lb. according to size and terms of order. For small quantities, 50@65c., same delivery.

Quicksilver—New York quotations are $45 per flask for lots of 100 flasks or over, and $46 for smaller orders. San Francisco quotations are $44.50@45.50 for domestic orders; for export nominal, at about $1.50 lower. The London price is £8 5s. per flask, with £8 3s. 9d. quoted from second hands.

Missouri Ore Market

Joplin, Mo., Feb. 1—The highest price reported paid for zinc ore was $42 per ton, on a base price ranging from $37 to $40 per ton of 60 per cent. zinc. The average price of the week was $36.32. The highest price paid for lead ore was $50 per ton in the bin, or $50.50 on the cars, and the average price of all grades was $48.60 per ton.

It is currently reported that one of the largest producing companies has entered into an experimental arrangement with one of the smelters, whereby the smelter is to reduce the ore to metal at a stated price, returning the metal to the ore-producing company.

Following are the shipments of zinc and lead from the various camps of the district for the week ending Feb. 1:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	1,878,380	445,330	$47,538
Joplin	1,631,100	229,730	38,250
Oronogo	695,830	.....	13,843
Galena	511,750	132,700	12,395
Duenweg	363,100	143,010	10,483
Granby	810,000	3,000	8,375
Aurora	310,320	4,590	4,633
Alba-Neck	200,290	.....	4,005
Badger	185,400	.....	3,800
Zincite	108,390	24,600	2,648
Prosperity	68,690	50,400	2,573
Spurgeon	126,890	13,750	1,870
Carthage	84,010	.....	1,680
Reeds	24,050	.....	456
Sarcoxie	18,320	.....	348
Totals	7,016,520	1,047,110	$152,897
5 weeks	35,479,300	4,704,070	$ 742,352
Zinc value, the week, $127,452; 5 weeks, $			632,001
Lead value, the week, 25,445; 5 weeks,			110,351

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1907.	1908.	Month.	1907.	1908.
January	45.84	35.56	January	83.58	46.88
February	47.11	.....	February	84.58	.....
March	48.66	.....	March	82.75	.....
April	48.24	.....	April	79.76	.....
May	45.98	.....	May	79.56	.....
June	44.82	.....	June	73.66	.....
July	45.79	.....	July	58.18	.....
August	43.22	.....	August	59.54	.....
September	40.11	.....	September	53.52	.....
October	39.83	.....	October	51.40	.....
November	35.19	.....	November	43.40	.....
December	30.87	.....	December	37.71	.....
Year	43.68	.....	Year	68.90	.....

Wisconsin Ore Market

Platteville, Wis., Feb. 1—The base price paid for zinc ore, 60 per cent., suffered a decline of $1 per ton during the week, from $40 to $39. The highest price paid during the week was $40.50 per ton.

Shipments for the week ended Feb. 1 were:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	421,260	.....	.....
Galena	219,200	.....	.....
Hazel Green	187,300	.....	.....
Livingston	140,000	.....	.....
Cuba City	65,000	.....	.....
Benton	51,340	.....	.....
Total	1,084,100	.....	.....
Year to Feb. 1	5,154,960	.....	.....

No shipments of lead ore were reported for the week.

Chemicals

New York, Feb. 5—The general chemical market is unchanged, and consumers are holding aloof, except for immediate needs. Little or no speculation is in evidence.

Copper Sulphate—A slightly firmer tone prevails but the volume of business is still small. The fact that the metal market is holding its own influences the copper sulphate market and it is believed that any change in prices will be an advance. Present quotations are $5.50 per 100 lb. for carloads and $5.75 for smaller lots.

Exports of copper sulphate for the full year were 18,732,177 lb. in 1906, and 7,257,953 lb. in 1907; a decrease of 11,474,224 lb. last year.

Phosphates—Exports of phosphates from the United States, year ended Dec. 31, long tons:

	1906.	1907.	Changes.
Crude	904,214	1,018,212	I. 113,998
Other	31,999	45,000	I. 13,001
Total	936,213	1,063,212	I. 126,999

The larger exports in 1907 were 321,582 tons to Germany; 165,181 to Great Britain; 141,931 to France.

Sulphur—Imports of sulphur and pyrites into the United States, year ended Dec. 31, long tons:

	1906.	1907.	Changes.
Sulphur	72,404	20,299	D. 52,105
Pyrites	597,347	656,477	I. 59,130

Estimating sulphur contents of pyrites, the total sulphur imports were 311,343 tons in 1906, and 282,890 in 1907; a decrease of 28,453 tons. Exports of sulphur were 14,437 tons in 1906, and 35,925 tons in 1907; an increase of 21,488 tons.

Heavy Chemicals—Imports of heavy chemicals into the United States for the year ended Dec. 31 were, in pounds:

	1906.	1907.	Changes.
Bleaching powder	105,221,371	112,090,783	I. 6,869,412
Potash salts	331,220,320	364,053,088	I. 32,831,768
Soda salts	22,556,100	17,876,159	D. 4,679,941

Exports of acetate of lime were 72,154,382 lb. in 1906, and 73,561,560 lb. in 1907; an increase of 1,407,178 lb. last year.

Mining Stocks

New York, Feb. 5—The general stock markets are still irregular and apparently without definite tendency. A sharp fall at the close of the week is ascribed rather to professional bear operations on the exchange than to any pronounced tendency. Closing prices are quoted rather lower than last week.

The curb market has been rather dull and weak, though fluctuations in mining stocks were within narrow limits. The copper stocks showed small sales for the most part. The Nevada stocks are rather neglected for the time. Cobalt stocks showed a little activity, but were not strong.

Boston

Feb. 4—The week has been a reactionary one in mining shares, although declines have been moderate and healthy. There is a glimmer of light in the situation. Prices, however, are at the command of the professional trader.

After touching $53, Amalgamated fell back to $51 and holds around this price. Copper Range stiffened slightly to $64.75, reacting to $62.75. The final instalment of $840,000 on the Tri-Mountain debt due to Copper Range has been paid under the compromise made last April. North Butte fell over $2 to $48.50, but has re-

covered partially, and Butte Coalition is off $1 net from a week ago to $18.50. Utah Consolidated fell from $41 to below $38. Boston Consolidated has been both weak and strong, closing a trifle off for the week at $16.12½. Arizona Commercial has been a strong feature with little net change for the week. Isle Royale fell $2 to $23.75 on profit taking, recovering partially. Arcadian is off $1 to $4.25. There is no significance in the change in the management, although it was not generally known. Balaklala has been under pressure, touching $2.37½. It is believed that the Boston interests will accede to the majority, or New York, interests, in their plans of reorganization.

STOCK QUOTATIONS

NEW YORK	Feb. 4
Name of Comp.	Clg.
Alaska Mine	7/16
Am.Nev.M.&P.Co.	....
Amalgamated	51¼
Anaconda	32⅞
Balaklala	2⅜
British Col. Cop.	4¾
Buffalo Cobalt	2⅛
Butte & London	.96
Butte Coalition	18⅝
Butte Cop. & Zinc.	....
Cobalt Contact	....
Colonial Silver	⅜
Cum. Ely Mining.	7¾
Davis Daly	4½
Dominion Cop.	2
El Rayo	1⅝
Foster Cobalt	.65
Furnace Creek	.29
Giroux Mine	4⅛
Gold Hill	⅞
Granby, New	....
Greene Gold	1
Greene G. & S	5/16
Greenw'r & D.Val.	.75
Guanajuato	2⅛
Guggen. Exp.	150
Hanapah	20
McKinley Dar.	7/16
Micmac	3⅞
Mines Co. of Am.	1⅛
Mitchell Mining.	¾
Mont.Sho. C.(New)	3
Nev. Utah M. & S	4⅝
Newhouse M. & S	....
Nipissing Mines	6⅞
Old Hundred	¾
Silver Queen	79
Stewart	1/16
Tennessee Cop'r.	....
Union Copper New	1⅜
Utah Apex	4¼
West Columbus	.11

N. Y. INDUSTRIAL	
Am. Agri. Chem.	17⅜
Am. Smelt. & Ref.	66¾
Am. Sm. & Ref., pf.	91
Bethlehem Steel	....
Colo. Fuel & Iron	18½
Federal M. & S.,pf.	....
Inter. Salt	15
National Lead	38½
National Lead, pf.	90¾
Pittsburg Coal	....
Republic I. & S.	16½
Republic I. & S.,pf.	68¼
Sloss-Sheffield	....
Standard Oil	485
Tenn. C. & I.	....
U. S. Red. & Ref.	....
U. S. Steel	28¼
U. S. Steel, pf	93¾
Va. Car. Chem	....
Va. I. Coal & Coke	....

ST. LOUIS	Feb. 1	
N. of Com.	High.	Low.
Adams	.25	.20
Am. Nettie	.03	.02
Center Cr'k	2.00	1.50
Cent. C. & C.	66.00	63.00
C.C. & C. pd.	76.00	74.00
Cent. Oil	100.00	90.00
Columbia	6.00	3.00
Con. Coal	24.00	22.00
Doe Run	120.00	110.00
Gra. Bimet.	.25	.20
St. Joe.	15.00	12.00

BOSTON	Feb. 4
Name of Comp.	Clg.
Adventure	2
Allouez	30
Am. Zinc	....
Arcadian	4¼
Atlantic	12
Bingham	5⅜
Boston Con	16
Calumet & Ariz	111¾
Calumet & Hecla	665
Centennial	24½
Con. Mercur	....
Copper Range	63¼
Daly-West	9½
Franklin	9½
Greene–Can	8⅝
Isle Royal	24½
La Salle	15
Mass	4
Michigan	....
Mohawk	55¼
Mont.C.&C. (new)	1⅛
Nevada	11
North Butte	49
Old Colony	....
Old Dominion	38¾
Osceola	85½
Parrot	13¾
Phoenix	....
Quincy	87
Rhode Island	4
Santa Fe	....
Shannon	12¼
Tamarack	....
Trinity	15⅛
United Cop., com.	....
U. S. Oil	10⅛
U. S. Smg. & Ref.	33½
U.S.Sm. & Re.,pd.	39¾
Utah Copper	37¾
Victoria	....
Washington	....
Winona	5¼
Wolverine	130
Wyandotte	....

*Ex. Div. †Ex. Rights.

BOSTON CURB	
Ahmeek	....
Ariz. Com	....
Black Mt	4⅜
East Butte	5½
Hancock Con	....
Keweenaw	....
Majestic	1⅛
Raven	1⅞
Shawmut	.39
Superior	19¼
Superior & Pitts	13⅞
Troy Man	.95

LONDON	Jan. 29		
Name of Com.	Clg.		
Dolores	£1	8s	9d
Stratton'sInd.	0	3	3
Camp Bird	0	15	9
Esperanza	1	2	6
Tomboy	1	7	6
El Oro	1	0	7½
Oroville	0	12	6
Somera	..	..	.
Utah Apex	..	..	.
Ariz. Cop.,pfd.	..	..	.
Ariz. Cop.,def.	..	..	.

Cabled through Wm. P. Bonbright & Co., N.Y.

NEVADA STOCKS. Feb. 5.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
TONOPAH STOCKS	
Belmont	2.00
Extension	1.62½
Golden Anchor	.06
Jim Butler	.50
MacNamara	.45
Midway	.85
Montana	2.00
North Star	.21
Tonopah & Cal.	...
Tono'h Mine of N.	6.00
West End Con	.40
GOLDFI'D STOCKS	
Adams	.10
Atlanta	.39
Blue Bell	.12
Blue Bull	.22
Booth	.28
Columbia Mt	2.
Comb. Frac	.86
Cracker Jack	.12
Dia'dfield B. B. C.	.24
Goldfield Belmont	.15
Goldfield Con	5.31½
Goldfield Daisy	1.12
Goldfield Mining	...
Great Bend	.28
Jumbo Extension	.58
Jumbo Mining	...
Katherine	.06
Kendall	.24
Laguna	...
Lone Star	.12
Lou Dillon	...
May Queen	.12
Mohawk	...
Oro	.16
Red Hill	.38
Red Top	...
Roanoke	.07
Sandstorm	.37
Silver Pick	.35½
St. Ives	.53
Triangle	.08
BULLFROG STOCKS	
Amethyst	...
Bullfrog Daisy	...
Bullfrog Mining	.09
Bullfrog Nat. B.	.14
Gibraltar	.16
Gold Bar	.40

Name of Comp.	Clg.
Golden Sceptre	...
Homestake King.	.55
Montgomery Mt.	.17
Mont. Shoshone C.	3.12½
Original Bullfrog.	.04
Tramp Cons	.23½
MANHAT'N STOCKS	
Manhattan Cons.	.24
Manhat'n Dexter.	.14
Jumping Jack	.07
Stray Dog	.10
Indian Camp	.06
GREENW'R STOCKS	
Furnace Creek	...
Greenwater &D.V.	...
Green'rCop.M.&S.	...
United Greenwa'r	...
MISCELLANEOUS	
Golden Boulder	.13
Hayseed	.30
Lee Gold Grotto	.11
Nevada Hills	3.25
Nevada Smelting.	1.37½
Pittsburgh S. Pk.	1.55
Round Mt. Sphinx	.30

COLO. SPRINGS	Feb. 1
Name of Comp.	Clg.
Acacia	7⅛
Black Bell	3
C. C. Con	5
Dante	9
Doctor Jack Pot.	6¾
Elkton	55
El Paso	32
Findlay	34
Gold Dollar	6½
Gold Sovereign	3¾
Isabella	38
Index	....
Jennie Sample	3⅞
Jerry Johnson.	....
Mary McKinney	....
Pharmacist	4¼
Portland	1.02
Un. Gold Mines.	6
Vindicator	....
Work	17½

New Dividends

Company.	Payable.	Rate.	Amt.
Alaska Mexican	Jan. 28	$0.50	$90,000
Alaska Treadwell	Jan. 28	0.75	150,000
Alaska United	Jan. 28	0.15	27,030
Amalgamated	Feb. 24	0.50	765,440
Am. Cement	Jan. 23	0.30	60,000
Cambria Steel	Feb. 15	0.75	450,000
Camp Bird, Ltd.	Feb. 3	0.24	246,800
Consolidation Coal	Jan. 31	3.50	358,750
Doe Run	Feb. 15	0.50	29,531
Dolores, Ltd	Feb. 27	0.15	59,400
El Oro	Jan. 15	0.36	388,800
Fairmont Coal	Jan. 31	2.00	240,000
Florence	Jan.	0.10	105,000
Francis-Mohawk	Jan.	0.05	45,500
Georges Creek C. & I.	Jan. 22	2.50	55,000
Hinds Consolidated	Feb. 27	0.02	100,000
Homestake	Jan. 25	0.50	109,200
Jamison	Jan. 18	0.02	7,800
Jeff. & Cl'f. C. & I., pfd.	Feb. 15	2.50	37,500
Jerry Johnson	Jan. 15	0.01	25,000
Montezuma M. & S.	Jan. 10	0.04	40,000
N. Y. Hond. Rosario	Jan. 25	0.10	15,000
Portland	Jan. 15	0.04	120,000
Tenn. Copper Co	Feb. 15	1.25	218,750
Vindicator Con.	Jan. 25	0.04	60,000

Assessments

Company.	Delinq.	Sale.	Amt.
Banner Hill, Cal	Jan. 6	Jan. 27	$0.10
Belcher, Nev.	Jan. 3	Jan. 31	0.10
Bullion, Nev.	Jan. 3	Jan. 27	0.05
Champion, Cal.	Jan. 2	Jan. 23	0.50
Chollar, Nev.	Dec. 27	Jan. 20	0.10
Confidence, Nev.	Jan. 3	Jan. 24	0.20
East Tintic, Utah	Jan. 14	Feb. 9	0.01
Imlay, Nev.	Jan. 24	Feb. 10	0.01
Lady Washington, Nev.	Jan. 9	Jan. 30	0.05
Lucky Dutchman, Nev.	Jan. 16	Feb. 8	0.01
Moduff, Utah	Jan. 3	Feb. 4	0.01
Nevada Superior, Nev.	Jan. 24	Feb. 21	0.05
N. Y. Bonanza, Utah	Jan. 4	Jan. 25	0.03
Pacific Tin Mines, Alaska.	Feb. 17	Mar. 23	0.02
Penn. Con., Cal.	Jan. 13	Jan. 29	0.10
Posey Canyon, Utah	Jan. 7	Jan. 25	0.01
Spanish Ridge, Cal.	Jan. 15	Feb. 5	0.02
Sunflower, Cal.	Jan. 30	Mar. 30	0.05
Wabash, Utah	Jan. 17	Feb. 8	0.12
Zeibright, Cal.	Jan. 6	Feb. 1	0.05

Monthly Average Prices of Metals

AVERAGE PRICE OF SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25.738
February	68.835	.....	31.852	.....
March	67.519	.....	31.325	.....
April	65.462	.....	30.253	.....
May	65.981	.....	30.471	.....
June	67.090	.....	30.893	.....
July	68.144	.....	31.366	.....
August	68.745	.....	31.637	.....
September	67.792	.....	31.313	.....
October	62.435	.....	28.863	.....
November	58.677	.....	27.154	.....
December	54.565	.....	25.362	.....
Year	65.327	.....	30.188	.....

New York, cents per fine ounce; London, pence per standard ounce.

AVERAGE PRICES OF COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24.404	13.726	24.825	13.901	106.739	62.386
February	24.869	.....	25.236	.....	107.356	.....
March	25.065	.....	25.560	.....	106.594	.....
April	24.224	.....	25.260	.....	98.625	.....
May	24.048	.....	25.072	.....	102.375	.....
June	22.665	.....	24.140	.....	97.272	.....
July	21.130	.....	21.923	.....	95.016	.....
August	18.356	.....	19.255	.....	79.679	.....
September	15.565	.....	16.047	.....	68.375	.....
October	13.169	.....	13.551	.....	60.717	.....
November	13.391	.....	13.870	.....	61.226	.....
December	13.163	.....	13.393	.....	60.113	.....
Year	20.004	.....	20.661	.....	87.007	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

AVERAGE PRICE OF TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	.....
February	42.102	.....	August	37.667	.....
March	41.313	.....	September	36.689	.....
April	40.938	.....	October	32.620	.....
May	43.149	.....	November	30.833	.....
June	42.120	.....	December	27.925	.....
			Av. year	38.166	.....

Prices are in cents per pound.

AVERAGE PRICE OF LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	.....	19.531	.....
March	6.000	.....	19.703	.....
April	6.000	.....	19.975	.....
May	6.000	.....	19.688	.....
June	5.760	.....	20.188	.....
July	5.288	.....	20.350	.....
August	5.250	.....	19.063	.....
September	4.813	.....	19.775	.....
October	4.750	.....	18.531	.....
November	4.376	.....	17.281	.....
December	3.658	.....	14.500	.....
Year	5.325	.....	19.034	.....

New York, cents per pound. London, pounds sterling per long ton.

AVERAGE PRICE OF SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.513	6.582	4.363	27.125	20.563
February	6.814	.....	6.664	.....	25.938	.....
March	6.837	.....	6.687	.....	26.094	.....
April	6.685	.....	6.535	.....	25.900	.....
May	6.441	.....	6.291	.....	25.563	.....
June	6.419	.....	6.269	.....	25.469	.....
July	6.072	.....	5.922	.....	23.850	.....
August	5.701	.....	5.551	.....	21.969	.....
September	5.236	.....	5.086	.....	21.050	.....
October	5.430	.....	5.280	.....	21.781	.....
November	4.925	.....	4.775	.....	21.438	.....
December	4.254	.....	4.104	.....	20.075	.....
Year	5.962	.....	5.812	.....	23.771	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.